Green Bonds an investment tool for resilient future: Helping to achieve Circular Economy business models

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract:

Climate change is one of the biggest collective action problems in society, it brings up the need for countries to transition towards smart, low-carbon economies over the next 20 years. To reach the emission reduction target, set by the Paris Agreement, a significant increase in the rate of existing building energy efficiency renovations and the generation and procurement of renewable energy is vital. If we adopt circular economy to make and produce materials, products, and food, we can surely begin to see an accomplished picture of a resilient, net-zero world. This work makes the case for the consolidation of the circular economy and financial gap in varied industries.

The financial sector plays a vital role in the transition into a low-carbon economy. In this thesis, we interpret the current green bond market development by analysing Climate Bond Initiative data focused towards labelled green bond market from 2015-2020. First, we study green bond issuance- directed towards the region, financial institutions, and industry type. Second, we randomly sample green bonds whose proceeds are directed towards circular economy projects and address the gap in the issuance considering industry criteria. This mixed evidence about the green bond market and investment towards circular economy-based projects would explain the pattern of what projects come under the circular economy category and how much is the percentage of proceeds directed solely towards the circular economy.

This thesis is based on a distinctive methodology integrating an extensive literature review, market data analysis with a wide range of green bond market participants. We highlight the current barriers explaining the lack of scalability of the green bond market; the perception of not investing in the circular economy and the need for a paradigm shift required for the scalability of the green bond market to achieve a circular economy in various industries. This thesis makes several recommendations to overcome these obstacles and opens the prospect of green bonds to finance a circular economy-based business model in the coming future.

Keywords: green bonds, circular economy, sustainable finance, barriers, enablers, sustainable investment, financial institutions.

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LIST OF ABBREVIATIONS

EIB - European investment bank

CE – Circular Economy

GBP – Green Bond Principles

CBI – Climate Bond Initiative

ESG – Environmental, Social Governance

ING - International Netherlands Group

ANB AMRO - Algemene Bank Nederland-Amsterdam Rotterdam

ICMA - International Capital Market Association

LAC – Latin America and Caribbean

ABS – Asset Backed Securities

YTW – Yield to Worst

YTM – Yield to Maturity

UoP – Use of Proceed

Chapter 1: Introductions

1.1 Why do we need to move towards Circular Economy

The world's population is growing and getting wealthier, and products are becoming cheaper and more affordable to the rising population. With urban areas growing in population, it is projected by the United Nations – About 68% of the world's population will be living in urban areas by 2050 (UN,2018), but the earth's raw materials are not limitless. As a result, global labor and raw material costs are on the increase. To mitigate this effect, circular economy business opportunities can offer new ways for businesses to grow and diversify.

COVID-19 pandemic has forced us to think of new ways to make things work, the transition to a circular economy approach is more relevant than ever. The principle of circular economy is way bigger than simply improving waste management and better recycling. It reaches far beyond incremental or end-of-pipe actions and can lead to the improved wellbeing of citizens and the environment. It is a systematic approach, focused on upstream design and innovation: eliminate waste and pollution, keep products and materials in use, and regenerate natural systems, following this systemic approach circular economy transition can unlock a series of economic, environmental, and societal benefits (Ellen MacArthur Foundation,2021).

It was reported in Circularity Gap, that about 100 billion tonnes of material become part of our global economy every year. However, of this massive amount, only 8.6% is cycled back into the economy. Following with recent studies showing that, material handling and use accounts for the vast majority (70%) of GHGs emitted, proving how crucial it is to look beyond the narrow energy focus of the current climate pledges to make a real impact. Application of circular strategies at the common point of materials and emissions hotspots, we can increase value-retention and cut excessive consumption, thereby slashing GHGs (Circularity Gap report ,2021).

In the coming years, various industries are going to have a considerable impact on the way the world's resources are used. But how do we change the pattern? The resource inefficiency of the predominant "take-make-use dispose" economy model can no longer be sustained in the long term. Instead, a circular economy (CE) based on reusing biological and technological resources for as long as possible in closed-loop systems should be deployed (Mendoza et al., 2017; Gallego-Schmid et al.,2020).

A recent report by Ellen MacArthur Foundation and Material Economics, (2019) pointed that if we apply circular economy strategies in just five key areas (cement, aluminium, steel, plastics, and food) we could eliminate almost half of the emissions from the production of goods – 9.3 billion tonnes of CO2 in 2050 – which is equivalent to cutting current emissions from all transport to zero.

The key problem with Linear economy is, it adds value at every step of the product life cycle, and by the end of life the value drastically drops. At the time of sale, ownership and liability of risks and waste pass from the manufacturer to the buyer. In this approach, the product once sold becomes the responsibility of the producer/manufacturer followed by user/buyer as the product owners. On the contrary, circular economy attempts to maximize the value at each point in a product's life (even beyond use) (Liu et. al, 2021, p.40)

Developing common understanding of what the circular economy is – the key to increase levels of financing to the circular economy, to achieve that level we need to first develop and agree on eligibility criteria (what makes a project/project component/business circular) for existing and new financial instruments, it will also help us for monitoring purposes and for assessing the additionality of circular projects versus linear projects (European Commission, 2019).

1.2 Financing the Circular Economy

In response, various circular economy initiatives by banking, and insurance products—such as peer-to-peer provisioning, zero-waste, upcycling, product leasing, remanufacturing, and reverse manufacturing—continue to emerge (Dewick et al,2020). These developments suggest that both governments and the financial industry are increasingly committed to support circular economy projects, with a particularly notable example being the EIB (European investment bank) commitment to invest EUR 10 billion (USD 12 billion) by 2023 as part of Joint Initiative Circular Economy by providing loans, equity investment, guarantees and developing innovative financing structure for public and private projects (European investment Bank,2020).

In addition. Intesa Sanpaolo launched its CE Plafond, a credit facility aimed to support the transition towards a Circular Economy. The CE Plafond, consisting of € 5 Billion (recently extended to € 6 Billion) within the 2018-2021 Business Plan, is dedicated to the most

innovative companies or projects in the Circular Economy field across all Italian and foreign markets. The company itself has recently, placed a third Green Bond with a nominal value of €1.25 billion focused on green mortgages granted for the construction or the purchase of energy-efficient properties (Intesa Sanpaolo,2021).

New private investment funds have appeared and begun to attract considerable attention. For instance, Global Asset Manager BlackRock recently announced that its investment fund focused on the circular economy has raised $900 million since its launch as of 2019, the BlackRock fund globally invests 80% of its total assets in shares of global companies that help in the advancement of Circular Economy (BlackRock, 2021). At the other end of the firm-size spectrum, Circularity Capital a private equity firm that invests in European growth-stage small to medium-sized enterprises operating within the circular economy, the firm closed its first private equity fund, the Circularity European Growth Fund, in January 2019 at £60 million, surpassing its £50 million goals (Clause,2020).

As economies look to rebuild from the impact of the Covid-19 pandemic, the circular economy offers an attractive path forward. With governments unveiling trillions of dollars in stimulus funding in response to the economic and health impacts of the pandemic, we have reached a crucial moment to harness forward-looking public investments and incentivize private investments towards a healthier, more resilient, low-carbon circular economy approach (Ellen MacArthur Foundation,2021)

1.3Green Bonds and the pathway to sustainability

Green bonds are fixed-interest loans with long-dated maturity (10-20) years designed to raise debt finance to fund climate-related investments issued by entities, such as government agencies, financial institutions, or by corporations to raise funds from investors to finance investments with some environmental benefits (Inderst, Kaminker, and Stuart 2012). The “use of proceeds” in the green bond market is developed around the idea of flat pricing – where there is no difference between the green bond price when compared with any ordinary bond. Prices are flat because the credit profile of green bonds is the same as the vanilla bonds from the same issuer, therefore green bonds are ranked equally as too vanilla issuance (Climate Bond Initiative,2019). Green Bond financings, issued by the public and/ or private entities, have the potential to reduce financing costs, given receptive and strong investor demand, driving, and encouraging environmentally supportive projects and economic growth (IIAC,2020).

Green bonds allow purchasers and issuers to align themselves in helping to mitigate climate changes, they provide transparency into the projects being financed and allow investors to measure the impact that their investment is making. Why Finance Circularity using green bonds? The Banking sector is recognizing the opportunities of sustainability more and more. It is observed that clients who are leading in sustainability are more innovative, show better financial performance and have better credit ratings. A healthy portfolio is indeed created for the banks that direct more assets and capital to sustainable businesses and helps them to facilitate the transformation to a low carbon economy. As a result, sustainability now is a business opportunity for the financial industry (ING,2015).

1.4 Thesis Structure

The first and current chapter of this thesis provides an introduction and some background information followed by the geographical description, the boundary, and the scale of the study area. The research questions and objectives of the research are also defined in this first chapter. In the second chapter, a summary of the literature review conducted for this research is provided. The third chapter contains a description of the methodological approach of the thesis explaining the variables considered and data used for analysis. The limitations of the analysis are also mentioned in this chapter.

The results of the study, which is to understand the investments directed towards circular economy via green bonds is provided in Chapter 4. All the quantitative analysis is done on Climate Bond Initiative Labelled green bond data from issued form 2015-2020. A discussion of the results is presented in the same chapter which includes an explanation of how the results can be used in industry and the policy implications associated with the results. Finally, in the final and fifth chapter of this thesis, recommendations for future work that can follow this study are mentioned as a suggestion for scholars who wish to pursue this research, and build upon its methodology and findings, and a conclusion is made available based on the obtained results.

1.5 Research objective and question

The layout of the green bond market today raises several questions. If we say that the financial characteristics of green bonds do not differ significantly from conventional bonds, what explains the high demand for green bonds among investors? Maltais & Nykvist, (2020) recent study has posited questions that is associated to this thesis proposal: What value are green bonds delivering to issuers and investors, and what difference do they make to the way issuers and investors interact with each other? The objective of this thesis is - understanding and exploring types of circular economy projects that are financed by green bonds to analyse the ratio of green bonds addressing CE.

Green bonds and climate bonds have received increasing attention over the past few years as key instruments to finance the transition towards a low-carbon economy. The motivation behind this research is to understand how the concept can be used to foster a strategic circular economy-focused business model with an objective being how green bonds have and can address circular economy from a financial instrument perspective. Even so, the paper argues about the persistence of the performance gab indicates the complexity of green bonds and circular economy business model in the research, it is aimed at mutually supporting and reinforcing instruments and measures to achieve a circular economy business model. Furthermore, this study aims to explore the key factors that either hinder or help the implementation of the circular economy.

Following the outlined purpose, this thesis is based on the subsequent research questions:

RQ1: What types of circular economy projects are financed by green bonds?

RO2: What is the ratio of green bonds addressing CE? Are there sectoral and regional differences in issuances of green bonds addressing CE?

Chapter 2: Literature Review

2.1 Approaching the Circular Economy

The paper published by UNDP and UNEP's, with a particular focus on how circular economy policies and measures can raise the ambition of countries' Nationally Determined Contributions to the Paris Agreement on climate change suggests that - Economic resilience in a rapidly changing world will require less linear production and consumption systems, which also reduce resource depletion, pollution including greenhouse gas emissions and disruption of natural ecosystems. The International Labour Organization estimates 6 million jobs, globally, could be created by 2030 through circular models. Chatham House in its recent report 'Promoting a Just Transition to an Inclusive Circular Economy stresses the need for well-designed public policies to achieve a transition to circular economies. While many governments have started to promote policies with circular economy aspects, there is a need for accurate information on the benefits of the circular economy. This requires new analytical tools and more integrated policies which support the transition to a truly circular economy (Alexandra & Charles,2020)

Increasing demand for resources leading to environmental disruption is one of the key drivers for the necessary shift (Hoornweg et al., 2013). The most important uses of materials in terms of embodied GHG emissions are those of cement, lime, and plaster in the construction sector (2.9 Gt CO2eq), and of steel in the manufacturing sector (2.8 Gt CO2eq) (Hertwich et al., 2019). Looking from an economic perspective, the surging volatility of raw materials prices has been highlighted as one of the main reasons to adopt CE principles (Heyes et al., 2018).

The authors (Liu et al., 2021, p.78) bring some information about the background of the problem - Sustainable transformation at every scale of industry is essential in circular economy, which is a complex and multi-scale system. At the product level, circular economy supports creation of eco-design which involves recycling, remanufacture, easy disassembly, biodegrading, etc. At the production level, circular economy tends to promote cleaner production, waste minimization, zero-waste discharge, etc. At industrial park level, circular economy tends to promote eco-industrial park, green industrial park, circular reform, etc. At the regional level, circular economy advocates closed circulation systems. At the global level, circular economy advocates sustainable transformation of global production networks (Liu et. al, 2021, p.78)

The differences between varied sectors require different approaches to adapt circular economy principles, depending on their circumstances (Lacy & Rutqvist, 2015). Several frameworks have emerged in the literature to guide CE thinking and decision-making within companies in different sectors (Mendoza et al., 2017). These frameworks typically focus on assisting companies in the development of CE solutions for products and their production processes. However, the frameworks that only improve the circularity of products are not enough to deploy CE across the whole economy (Heyes et al., 2018).

2.2 Obstacles for circular economy Growth

There have been numerous studies that suggest one of the technological barriers as mentioned by (Grafström & Aasma, 2021) is - in many countries, separation of waste is limited, which affects the quality of recycled goods and materials. The infrastructure for effective waste management is lacking in many places. Many recyclables are not sorted or separately collected. The initiative circular economy practices require markets for secondary resources and second-hand goods. Many of these markets are nowadays absent due to insufficient demand or supply, in other cases, a lack of consumer demand is the key issue. The innovative nature of the circular economy makes investing in CE risky (ING report, 2020)

Considering the market barrier, think about recycled materials, the condition of the material is dependent on the consumption pattern of customers. Activities like the usage of resources and extraction have an environmental cost (think of air pollution and biodiversity loss). These costs are referred to as 'externalities' because they often fall outside of the current market mechanism and remain unpriced making the financial cost of primary resources usage lesser than the cost of secondary resources (ING report, 2020) Uncertainty decreases willingness to invest in recycled material markets, and the substitution to recycled material markets stays low (Grafström & Aasma, 2021).

'Linear Risks' account for developments and trends such as future volatility in resource supply and price, failures in the value chain, and disruptive new business models (European Bank for reconstruction and development, 2018). A recent study by (World Resources Institute,2020) concluded that, every entity offers unique financial, intellectual, and operational assets may it be companies, investors, governments, or civil society individual perception of everyone if strategically deployed can help us to solve big problems that can't be solved alone. For example, the World Bank found to build water infrastructure in Africa public-private

partnership were most effective as when a project is financed by a mix of private and public sources, the public funding reduces risk to private investors and private investors' return requirements improves efficiency and prevents cost overruns (World Bank,2014).

Dewick, (2020) advances the idea that— financiers will not have adequately reliable information to create innovative vehicles to forge a pathway toward the circular economy without developing and implementing a set of international specifications that are simultaneously robust and flexible—and are grounded in an overarching framework supported by simple but sophisticated tools that provide circularity metrics consistent with strong sustainability. Investors, whether they are active or passive, want to know that a fund ostensibly investing in the circular economy includes stocks that have been selected based on sound criteria. Until then, circular economy finance is less a clear winner and more of a risky proposition.

2.3 Maximizing finance for Circular Economy

As more companies, governments, and consumers are motivated to find new opportunities to invest in circular economy business models, policies, and consumption patterns an investment growth is observed. For instance, the World Bank Group has already financed several projects supporting the transition to a circular economy. The World Bank assistance to client countries includes (Liu et. al, 2021, p.474): (i) Investment Project Financing, providing loans, grants, and guarantee financing to governments for activities that create infrastructure; (ii) Development Policy Financing that supports policy and institutional actions designed by client countries; (iii) Program-for-Results that links disbursement of funds directly to the delivery of defined results; (iv) trust funds and grants that allow scaling up of activities; and (v) Private Sector Financing (Liu et. al, 2021, p.474).

There are several financing opportunities that the circular economy presents ranging from consumer lending and leasing to large project financing, green bonds, and equity capital. For example, the BCF Circular Economy (BGBCEAU) Fund, launched in the year 2019, is an equity asset class with the size of fund worth USD 2,170 M - The Fund aims to provide a return on your investment through a combination of capital growth and income on the Fund's assets. The Fund invests globally at least 80% of its total assets in the equity securities (i.e., shares) of companies that benefit from, or contribute to, the advancement of the "Circular Economy"

(Blackrock,2021). All companies that make up this fund are first screened using the firm's ESG criteria to ensure the entire fund measures up as "sustainable," and to increase the likelihood of compelling risk-adjusted returns (Byrne,2020). Top holdings of this fund are: ASML HOLDING NV (3.57%), COCA-COLA EURO PACIFIC PARTNERS PLC (3.41%), OWENS CORNING (3.41%), MICROSOFT CORP (3.36%), LOREAL SA (3.02%). (BlackRock,2021).

How can retail investors invest in green bonds? Retail investors can't access the bond market directly, however, there are increasing mutual funds and exchange-traded funds that are investing in green bonds, so retail investors can tap through their brokers or banks. Example of ETF: The iShares Global Green Bond ETF (the "Fund") seeks to track the investment results of an index composed of global investment-grade green bonds that are issued to fund environmental projects while mitigating exposure to currency fluctuations versus the U.S. dollar (BlackRock-ishares,2021) other options are EAGG iShares ESG Aware U.S. Aggregate Bond ETF and SUSB iShares ESG Aware 1-5 Year USD Corporate Bond ETF.

It was reported by (Otek Ntsama et. al, 2021) in literature; the need for lower costs and transparency in ESG investments is crucial -The managers of actively managed green bond funds charge higher fees to cover research costs and analysts' salaries. On the other hand, the Exchange-Traded Funds rules-based approach that replicates indices would reduce costs for investors. Thus, Improved ESG data collection, processing, and standardization allow index providers to codify ESG targets in benchmarks with high accuracy, rigor and create transparency as all investors want to know where their money is going, especially when it comes to ESG investments (Otek Ntsama et. al, 2021).

Furthermore, green bonds frequently attract a new group of investors to an issuer, thus increasing investor community. Also, green bonds carry a public relations benefit as firms strive to be identified as being on the "right side" of climate change, and thus for this thesis, we considered investigating a bit more to find investments correlation between green bonds and circular economy.

2.4 Green Bond Market

There is currently a lack of a universal definition of green bonds as to what correctly constitutes an eligible use of proceeds that is environmentally friendly and climate-resilient (Park 2018). In 2019, the financial performance of the green bond market was supported by the overall downward movement in rates, the Bloomberg Barclays MSCI Global Green Bond Index, the most followed index by managers - gained 6.50% over the year, after the year 2018 in the red (− 0.72%) (Otek Ntsama ,2021). The author (Zhang, 2020) brings some information about the background of the problem by asking a fundamental question, *how can investors be ensured that the proceeds of green bonds are not "green-washed"* and that the eligible proceeds are in fact invested in green and low-carbon economy-based projects? (Ehlers & Packer, 2017)

The literature review by (Zhang, 2020) shows that several organizations have also emerged to provide green label certifications based on various green labeling standards. The indication of adherence to standards of green labeling enables investors who are keen to invest in green projects to identify which green bonds they would like to invest in. A critical open question is about the potential loophole of "greenwashing" as one of the major stumbling blocks to the success and integrity of the green bonds market globally. As essential components of the green bond market in terms of governance and rulemaking, the GBPs, and Climate Bonds Initiative (CBI) provide some essential regulatory and governance elements, particularly the use of proceeds and disclosure requirements (Zhang, 2020).

Wang et al. (2019) studied the key factors that influence the risk premium of issuance in China's green bond market. The results obtained revealed that debt credit rating, issue period, and issue size are three different factors that directly impact the risk premium of green bond issuance (Anh tu et. al,2020). A recent study by Broadstock and Cheng (2019) argued that the development of the green bond market depends on various factors that influence the development of green bonds. Using the dynamic conditional correlations (DCC) along with dynamic model averaging methods their results show the correlation between green bond and black bond where they both are sensitive to macroeconomic/macro-level factors including changes in financial market returns and volatility; economic policy uncertainty; and uniquely

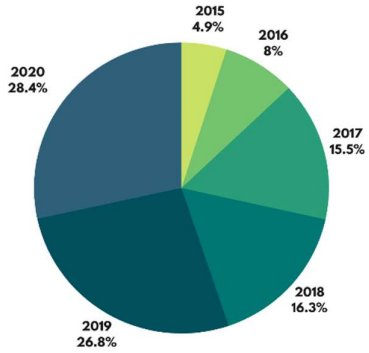
constructed measures of positive and negative news-based sentiment towards green bonds (Broadstock & Cheng, 2019).

Google parent company Alphabet - raised an unprecedented USD 5.75bn in sustainability notes, as part of a broader USD 10bn issuance. One of those ESG-oriented maturities, the 5Y tranche, offered a coupon of just 0.45%, matching the record low coupon for the tenor. Google says the issuance will fund projects in eight areas: energy efficiency, clean energy, green buildings, clean transportation, circular economy, affordable housing, racial equity, and COVID-19 support to small businesses (Google,2020).

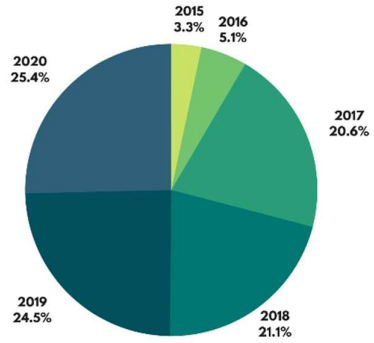
Several financial players, including the International Netherlands Group (ING), De Lage Landen (DLL), Algemene Bank Nederland-Amsterdam Rotterdam (ANB AMRO), Intesa Sanpaolo, Triodos Bank, PGGM (Dutch Pension fund for employees in the health and welfare sector), European Investment Bank (EIB), and others, already made their first steps towards supporting circular business practices. Some of them have already adapted their product portfolio to specifically target this new circular way of doing business. This is crucial since the financial sector can be a powerful force to drive the circular transition. This does require a different view on risks and returns, the incorporation of intangible capitals (e.g., social and natural capital) into financial decision-making, and a long-term vision (Goovaerts,2018).

The Green Bond market is about 10 years old, and the data analysis done on Climate Bond Initiative five-year data from 2015-2020 has gained rapidity over time. The preceding left pie chart in Figure 1, represents the total amount of green bonds issued in USD($B) year-wise which has risen from 4.9% to 28.4 % from 2015 to 2020.In the right pie chart around early 2015, there were 253 bonds issued with a total market value of USD 44.36B. By 2020, the number of bonds has risen to 1921, and their total market value has passed – at USD 255. 29B.There is a drastic leap in the amount and issuance of bonds issued from 2016-2017 from 72 USD($B) to 139 USD($B).

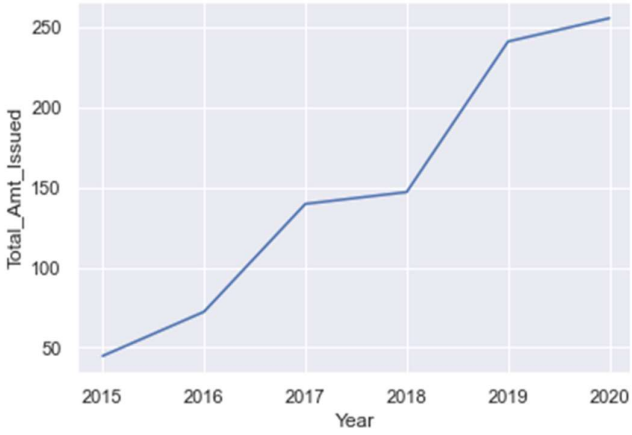
Year	Total Amount Issued ($B USD)	No_of_bonds _Issued
2015	44.725	252
2016	72.029	388
2017	139.527	1560
2018	146.898	1597
2019	240.764	1853
2020	255.29	1921



Total Amount issued ($B USD)



No of Bonds from 2015-2020



Upward trend in green bond issuance since 2015

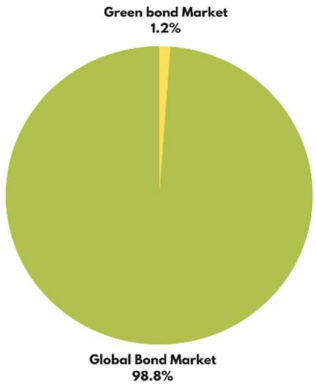


Figure 1: Green bond Market overview – (CBI, Data from 2015-2020) – (approximate values)

The total cumulative green bond issuance to date is about $1.45 trillion, the pie chart above represents a market share of just 1.2% as compared to global bond market. As per, Capital Markets Fact Book, 2021 - Global bond markets outstanding value increased by 16.5% to $123.5 trillion in 2020, while global long-term bond issuance increased by 19.9% to $27.3 trillion the data shows a significant gab in bond market financing green projects.

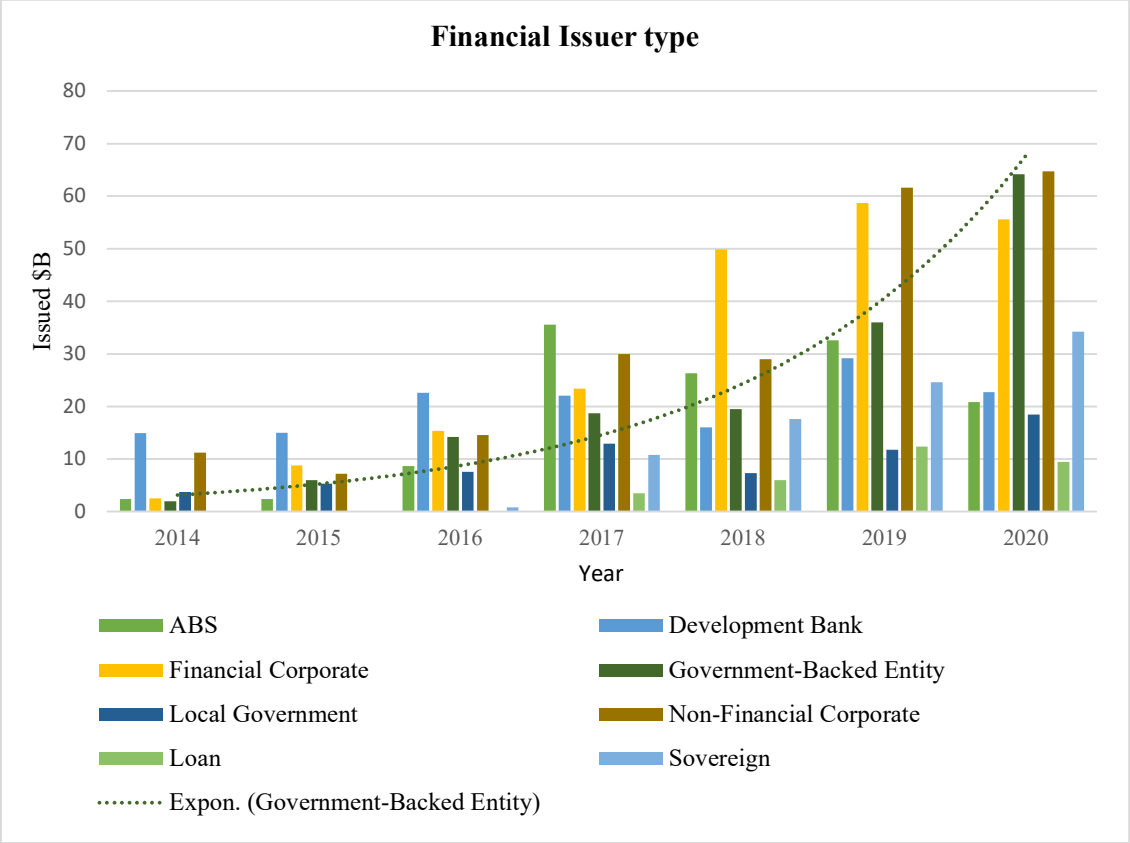


Figure 2: Financial Issuer type in green bonds Market (CBI Data)

As per CBI interactive platform data, 2020 growth in Green Bonds was characterised by a rise in public sector issuance, while private sector volumes remained static. As per the above plot, the largest increase is seen amongst the government-backed entities (GBEs**),** whose volume grew 78% and number of deals more than doubled. A significant share of this originated from France, particularly from Société du Grand Paris. GBEs also topped the ranking in Social, achieving almost 50% due to the EU's SURE bonds. Development banks saw a drop in green issuance, as many turned their attention to issuing Sustainability and Social debt to address the impacts of COVID-19. Driven by large MDBs, they dominate in the Sustainability theme, reaching almost 2/3 of the 2020 and overall volume. The local governments in certain countries cannot issue bonds at all because they are financed on a higher (state, provincial) level.

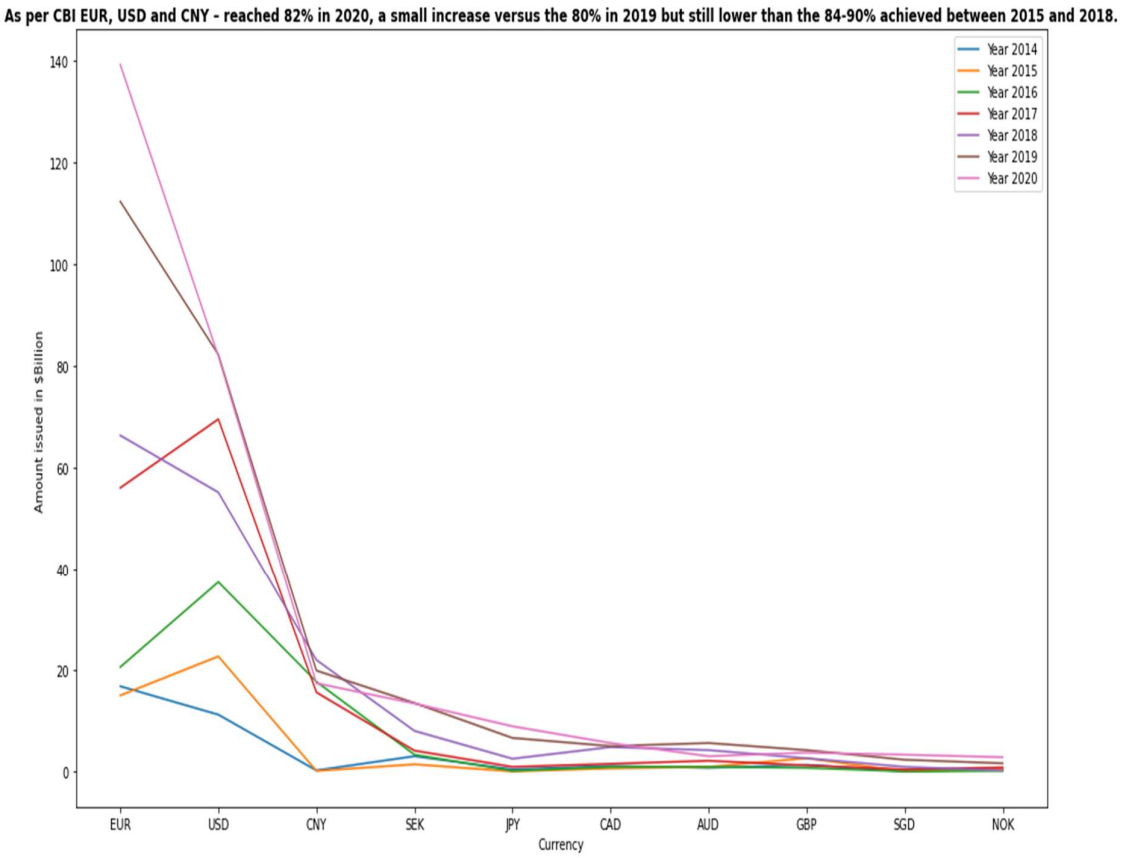


Figure 3: Top 10 currencies issued with respect to year; Source:(CBI Interactive data platform)

The EUR cemented its position as the leading currency, but as the world's reserve currency, USD attracted the largest number of international issuers. According to Climate Bond Initiative data, Europe accounted for the bulk of global green bond issuance in 2020 by surpassing $1 trillion for the first time. About 40 % of green bonds in 2020 were denominated in euros, compared to 35% in U.S dollars and 8% in Chinese yuan.

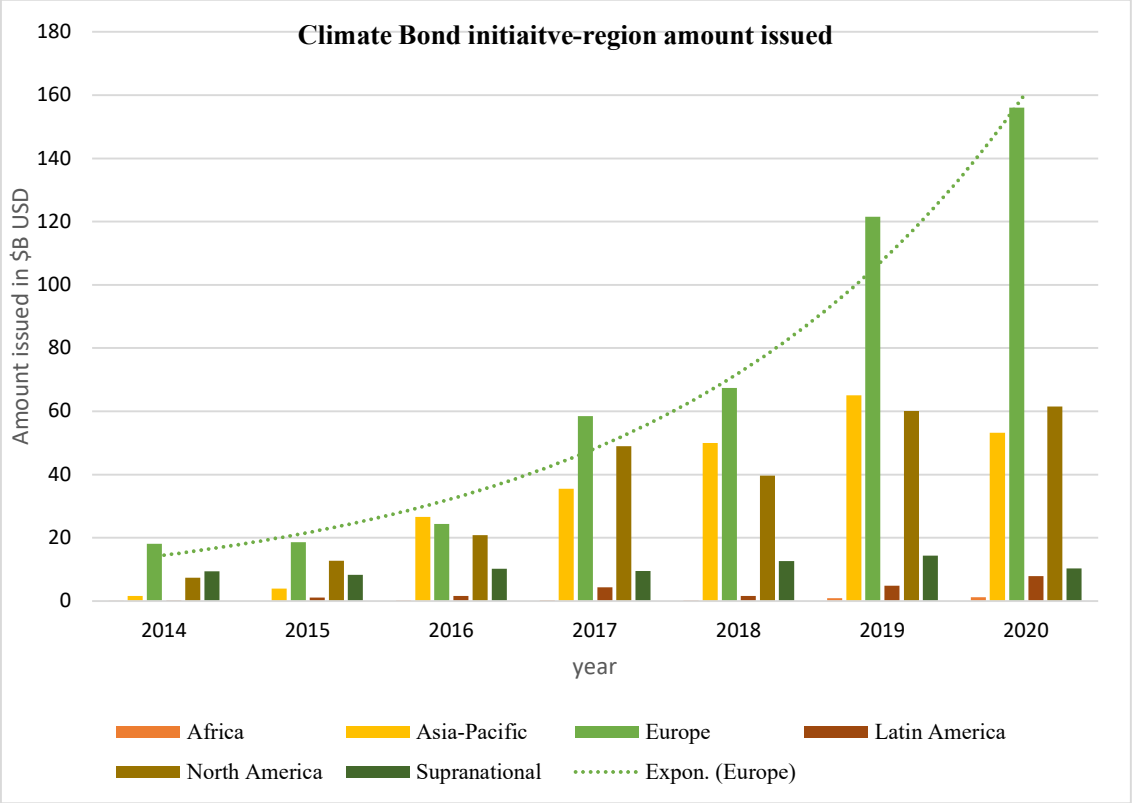


Figure 4: Regional Amount issued from 2014-2020: Source (CBI Interactive data platform)

As per the Climate Bond Initiative data - Europe is the leading region overall, but the regional profile varies considerably between themes. Europe dominates in **Green,** driven by a more mature green bond market which includes many large issuers from both the private and public sector. Asia-Pacific is the largest in **Social,** largely due to heavy pandemic bond issuance from China in the first half of 2020. Supranational form the second-largest group in Social and are the clear leader in the **Sustainability** theme.

It was reported in literature by (Otek Ntsama et. al, 2021) that the main obstacles faced by portfolio managers investing in low- and medium-income countries markets is that ESG standards can be very different from those in Western countries. The financial sector determines the conditions for construction, development, and refurbishment projects due to the conditions for finance and insurance. This heterogeneous group of financial stakeholders (banks, insurance companies, private investors, government entity) will be analysed with respect to their responsibilities and opportunities to contribute to the sustainability of the built environment (Lützkendorf et al., 2011). Both society and the academic world are questioning green finance on its ability to deliver what it has pledged to do (i.e., enable more sustainable

projects on the ground) (O'Sullivan & O'Dwyer 2009; Macve & Chen 2010). The research of this thesis takes on the question from here; that is, how to enable more green bonds through the empirical study of green finance in the various industries.

A more comprehensive description of the overall green bond issuance is put together by (Saravade & Weber, 2019) in an efficient manner -The issuer discloses the use of proceeds for the chosen type of green bond. Followed by it a framework is then developed to display how the use of proceeds will be monitored. Often, an independent second opinion on this framework comes from various advisory firms like an environmental think tank (such as CICERO), investor-focused groups (such as the Climate Bonds Initiative), other private ESG rating companies (for instance, Vigeo Eiris, ISS ESG), as well as domestic rating companies in certain countries (for instance, Sustainalytics). The second party opinion/external reviews are made public and further the issuer and investors discuss about the ESG metrics. Once the issuance of green bond is completed the issuer reviews the progress of projects (on an ongoing basis) financed by the green bond and provides periodic reports on the use of proceeds for the benefit of investors. However, due to a lack of standardization in the market, this process can vary in its time frame, and the amount of disclosure is dependent on the issuer (Saravade & Weber ,2019).

To avoid greenwashing, the International *Capital Market Association* (ICMA) recommends issuers to consult an independent external reviewer to confirm the alignment of their green bonds with the 'Green Bond Principles' (GBPs) (Dorfleitner et al, 2021). Voluntary Process Guidelines for Issuing Green Bonds, the GBP (Green Bond principles) recommends a clear process and disclosure for issuers, which investors, banks, underwriters, placement agents, and others may use to understand the characteristics of any given Green Bond. The GBP emphasizes the required transparency, accuracy, and integrity of the information that will be disclosed and reported by issuers to stakeholders (ICMA, 2018).

As per the (ICMA, 2018) report -The four core components for alignment with the GBP are 1. Use of Proceeds: Refinancing/Financing projects that contribute to environmental objectives such as climate change mitigation, natural resource conservation, and pollution prevention and control.2. Process for Project Evaluation and Selection: Green bond issuers should communicate the environmental sustainability of the projects to their investors 3. Management of Proceeds: The GBP specifies that proceeds (funds) are managed properly in a

sub-account, a sub-portfolio, or are attested by the issuer in a formal internal process 4. Reporting: Issuers are required to report on the allocation of proceeds to the eligible green project.

The eligible Green Projects categories, listed by (ICMA,2021) which issuers follow to categories their projects underuse of proceeds are as follows:

1. **Renewable energy** (including production, transmission, appliances, and products)
2. **Energy efficiency** (such as in new and refurbished buildings, energy storage, district heating, smart grids, appliances, and products)
3. **Pollution prevention and control** (including reduction of air emissions, greenhouse gas control, soil remediation, waste prevention, waste reduction, waste recycling, and energy/ emission-efficient waste to energy).
4. **Environmentally sustainable management of living natural resources and land use** (including environmentally sustainable agriculture; environmentally sustainable animal husbandry; climate-smart farm inputs such as biological crop protection or drip-irrigation; environmentally sustainable Voluntary Process Guidelines for Issuing Green Bonds 4 fishery and aquaculture; environmentally sustainable forestry, including afforestation or reforestation, and preservation or restoration of natural landscapes);
• **Terrestrial and aquatic biodiversity conservation** (including the protection of coastal, marine, and watershed environments)
• **Clean transportation** (such as electric, hybrid, public, rail, non-motorized, multi-modal transportation, infrastructure for clean energy vehicles and reduction of harmful emissions); • Sustainable water and wastewater management (including sustainable infrastructure for clean and/or drinking water, wastewater treatment, sustainable urban drainage systems and river training and other forms of flooding mitigation)
• **Climate change adaptation** (including efforts to make infrastructure more resilient to impacts of climate change, as well as information support systems, such as climate observation and early warning systems)
• **Circular economy adapted products, production technologies, and processes** (such as the design and introduction of reusable, recyclable and refurbished materials, components, and products; circular tools and services); and/or certified eco-efficient products
• **Green building**s that meet regional, national, or internationally recognized standards or certifications for environmental performance.

While the GBPs layout categories of eligible projects, they don't justify completely why some project types qualify while others do not. For example, a bond to fund sustainable agriculture would qualify under the GBPs, but another bond that funds animal welfare improvement— a passionate issue that many consider environmentally responsible— would not qualify (Reed et. al,2019; ICMA 2018).

Our research shows that most authors focus on the interrelationships among the circular economy and finance but very few focus on green bonds as that financial instrument. For this reason, using this research as a medium we will try to understand how we can make investors divert their money more towards circular economy projects. As Governments alone cannot finance our Sustainable Development Goals, and private capital is essential. Long-dated, income-generating projects are well suited for financing through loans or green bonds (VanEck,2020). The growth of the green bond market reflects this opportunity, allowing investors to potentially achieve both sustainability and investment objectives, without having to compromise on either.

Chapter 3: Methods

This research aims at analyzing green bonds as an essential part of the green financial system using the Climate Bond initiative data. The Climate Bonds Initiative is an investor-focused not-for-profit. The work of the organization revolves towards accelerating the transition to a low carbon economy by shifting the largest capital market of all: the $100 trillion bond market for climate solutions. The data provided by the CBI consists of bonds with at least 95% proceeds dedicated to green assets and projects that are aligned with the Climate Bonds Taxonomy. For example, sustainability bonds with wider use of proceeds or bonds which fund large amounts of working capital would be excluded (CBI,2018)

The study for this research is focused on analyzing Climate Bond Initiative green Bond data from 2015 to 2020. The variables considered for this study are Issue Date, Maturity Date, Issuer type, Country, Region, Amount Issued in USD($M), and the use of proceeds in various industries. Quantitative data followed by data visualization is used to describe investors' characteristics and financing statistics while qualitative analysis is used to examine investors' contributions towards green projects. The table of the top 10 green bonds issuers for the respective region is mentioned in Annexure 1.

To identify the ratio of green bonds addressing the circular economy, from the 8070 observations, the data were sorted according to unique issuers, removing all the null values from the data - giving 771 unique issuers. After acquiring the unique observation, a thorough study of second party opinion reviews was carried out of roughly 400 reviews due to data limitations to understand the proceeds of the green bond which will be used to finance and/or refinance, in whole or in part, new or existing projects which are considered under Eco-efficient and circular economy products, production technologies and processes category. After thoroughly going through the reviews and looking for the word “circular economy”, understanding what kind of projects are considered by an issuer as circular projects we were downright pointed towards 27 issuers who are partially investing part of their green bonds proceeds towards circular economy projects. A description of the projects considered under the circular economy category as per second party opinion reviews used in the thesis is provided in Annexure 2.

The Second party opinion reviews which follows The Green Bond Principles (GBP) suggests that the projects addressed should have clear environmental benefits, and project

selection should be well defined. So, to determine the sector of the project we did a thorough reading of the project assessment section provided in the second party opinion reviews and we abided by the sectors/category type mentioned in the reviews for the selected issuers. Also, if the sector/category type isn't clear in the reviews we tried to understand the description of the project and accordingly added the sector for few issuers.

To explore the variance of 27 issuers, Two-way ANOVA method is used to test whether the mean of a continuous variable (i.e., Amount issued in USD) differs across subsets of the data, as defined by two categorical variables (i.e., sector, region). We also added a coupon rate attribute for the analysis of these issuers. The coupon or interest rate defines the rate of interest paid on the bond. The size of the coupon indicates the credit risk of the bond. The higher the coupon, the greater the riskiness of the issuer as an investor will require a higher interest rate to compensate them for the greater likelihood of the issuer defaulting (Veys, 2010).

Chapter 4: Results and Discussions

4.1 Empirical Analysis - Green Bond Market CBI Data

To identify the regional characteristics of the green bond market ranging from 2015-2020, we first delve into the description of our dataset. To this end, we present summary statistics in Table 1, while proceeding plots in a further section of this chapter present the distribution of issuers as per respective sector and region.

Table 1 gives a generalized overview of the dataset, here the table is divided into two parts which addressed two key attributes from our dataset. The columns for both the parts represent the regions considered in our data analysis and the rows describe the basic statistics. As per our dataset, the Amount issued in USD($M) and the Maturity date are the two main factors considered to create the summary statistics for respective regions. The count represents the number of data points observed in the respective region from 2015-2020, with the highest being in N America and the least in Africa. Mean represents the mean of the total amount issued for the respective region followed by the mean for the maturity date. The standard deviation shows the average amount of variability in the data set for both factors followed by the minimum and maximum amount and maturity date observed in the overall dataset. See Annexure 1 for more details.

Table 1: Summary Statistics

	Amount issued in Millions (USD)					Maturity Date				
Year 2015-2020	Europe	Africa	N America	Supranational	Asia-Pacific	Europe	Africa	N America	Supranationals	Asia-Pacific
count	1518	20	4990	389	1036	1474	17	4971	389	967
mean	270.12	134.51	52.68	197.93	221.87	2027	2027	2030	2025	2025
standard deviation	372.18	191.1	135.18	279.94	244.32	8.155	4.43	5.74	7.186	6.433
min	0.239	4.809	0.015	0.875	0.47	2017	2021	2016	2017	2016
25%	29.37	39.87	9.605	14.61	63.91	2023	2024	2028	2021	2022
50%	78.96	59.07	17.85	61.905	131.88	2025	2027	2029	2025	2024
75%	454.85	125.52	35.24	279.88	300	2029	2030	2031	2027	2028
max	2006.4	750	2021.26	1500	2110.74	2120	2036	2080	2061	2060

Source: Authors Compilations- CBI dataset summary from 2015-2020

For research purpose the data frame removes all the null values from the provided data by CBI making the size of Data frame as (8111,10) with year range from 2015-2020.The data covers a significant amount if global green bond market, see Annexure 1 for more information on the no of observations in the dataset for respective year. The values obtained during data

visualization process are approximate values. The data is converted from local currency to constant USD. This data is used as a proxy for total green bond market capitalization in countries throughout the world. Thus, this study incorporates a sizeable portion of the global $1.237 trillion in climate and green business-aligned bonds outstanding provided by CBI for research purpose, as the CBI dataset provides one of the most comprehensive and accurate sources of green bond information, it can reasonably stand as a representative sample of green bond market capitalization (Tolliver et al, 2020).

To visualize the relationship between numerical variables and Bond Region the correlation matrix below shows us the 'correlations' between pairs variables in a given dataset. Each cell in the grid represents the value of the correlation coefficient between two variables. A large positive value (near to 1.0) indicates a strong positive correlation, i.e., if the value of one of the variables increases, the value of the other variable increases as well. A large negative value (near to -1.0) indicates a strong negative correlation, i.e., the value of one variable decreases with the other's increasing and vice-versa. There is negligible positive relationship between issuance of bond as per various region and the Amount Issued in USD

Figure 5: Correlation Matrix of 8070 observations sorted bond region wise.

There is a small positive correlation of 0.3 observed between region and Amount issued in USD variable for the rest we observe weak correlations which seem to occur when an association between two features is not obvious or is hardly observable as seen above.

The error bars in the bar plot represent the confidence interval for the variable, i.e., it is an interval where 95 % of the variable lies. The length of the preceding plot of an Error Bar helps reveal the uncertainty of a data point: a short Error Bar shows that values are concentrated, signaling that the plotted average value is more likely, while a long Error Bar indicates that the values are more spread out and less reliable. Also depending on the type of data, the length of each pair of Error Bars tends to be of equal length on both sides. However, if the data is skewed, then the lengths on each side would be unbalanced. While doing analysis of Bond region sorted year wise the data is not equal for all the regions thus makes the plots average value vary significantly. Attributes table is attached in the Annexure 1of this thesis.

The preceding bar plots represent variation in the issuance of green bonds as per bond Region (Africa, Asia-Pacific, Europe, LAC, North America, Supranational). Figure 6: Bar graphs below can give us a biased impression of central tendency. For example - Europe is leading issuers as per Figure 4 but in the graph, below we find Africa in a leading position for the year 2015 and 2020, here due to no uniformity in the data for these years we observe a biased graph as no of observation for one region is more and for other is less.

The sum of green bond Issuance in the year 2015 was approximately USD 44.725B with a consistent rise to USD 72B in the year 2016, USD 139 B in the year 2017, USD 147B in the year 2018, USD 241B in the year 2019 and USD 255.3B in the year 2020. The highest issuance of green bonds with a sum of USD 18.5B was issued by Europe in the year 2015 and lowest by LAC with USD 1.06B in the year 2015. In the year 2016 Europe contributed USD 24.2B followed by N America of contributing USD 20.9B and comparatively low by Africa with USD 167M.In the year 2017 N America contributed USD 48.9B followed by Europe at USD 45.7B. In the year 2018 Europe contributed USD 53B followed by Asia-Pacific with USD 41.3B. In the year 2019 Europe contributed about USD 101B followed by N-America with USD 60B. In the year 2020, we see a steady increase in Europe contribution towards the green bond market with issuing green bonds worth USD 114.5B followed by N America with USD 61.4B making Europe at the forefront of the green bond market followed by N America and Asia-Pacific region.

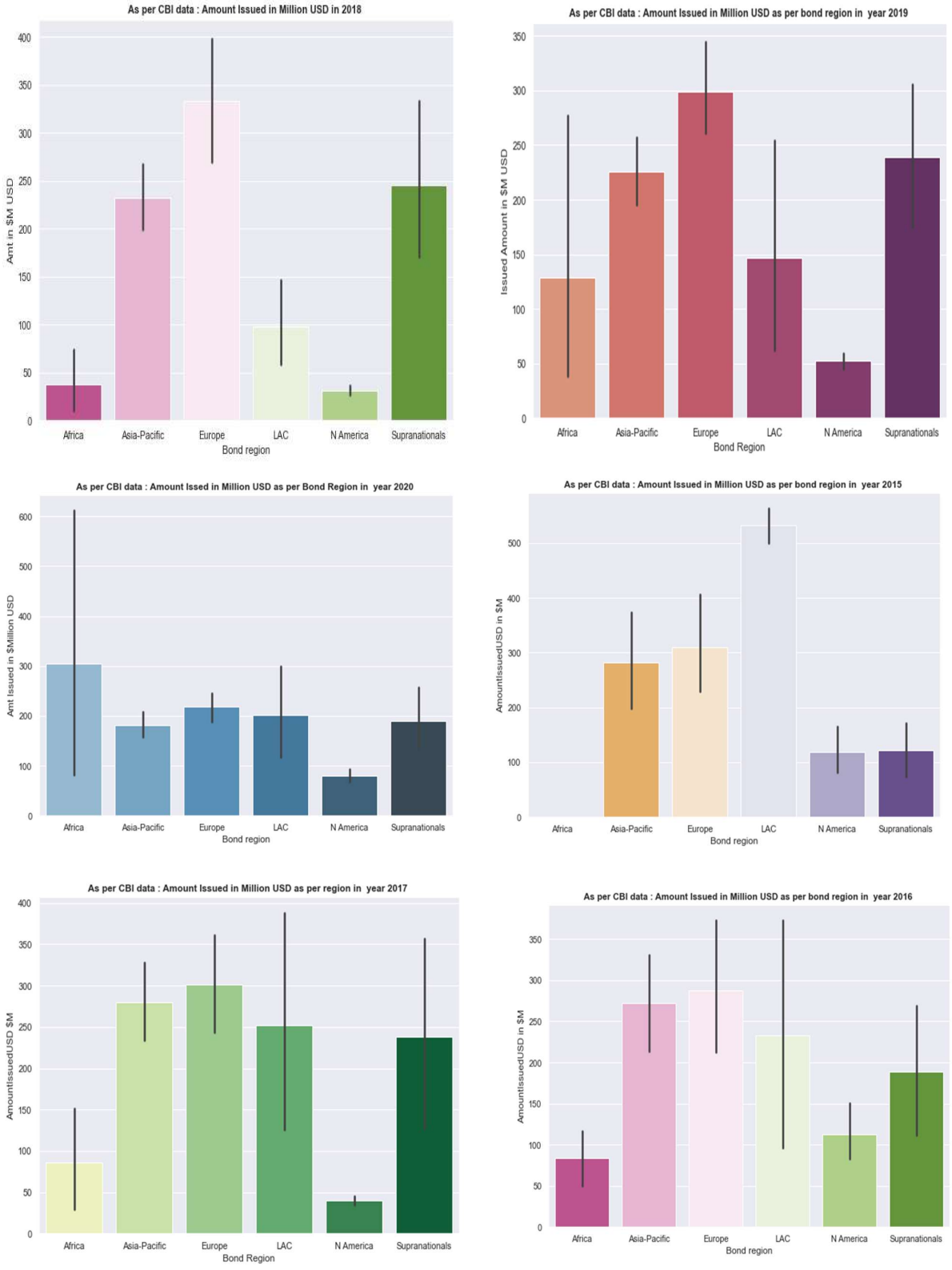


Figure 6: Amount issued in USD($M) as per Bond Region from 2020-2015 (CBI, Data)

4.2 Country contribution to Green Bond Market in respective year

With the first issuance of green bond issued in 2007 by the European Investment Bank - Europe has proven to be the cornerstone in the green bond market, with cumulative issuance totaling EUR 410B representing the largest regional market. European issuers span the continent and the spectrum of issuer types. They have issued in a variety of debt formats, currencies, and tenors. Sector diversity has grown over time. 98% of issuance benefits from external reviews and reporting standards are high. The largest contributing European country in Figure 7 is France with an amount issued in total USD 2.006B issued in 2018 and maturity date 2020 by Société du Grand Paris where the use of proceeds is invested in the Transportation sector.

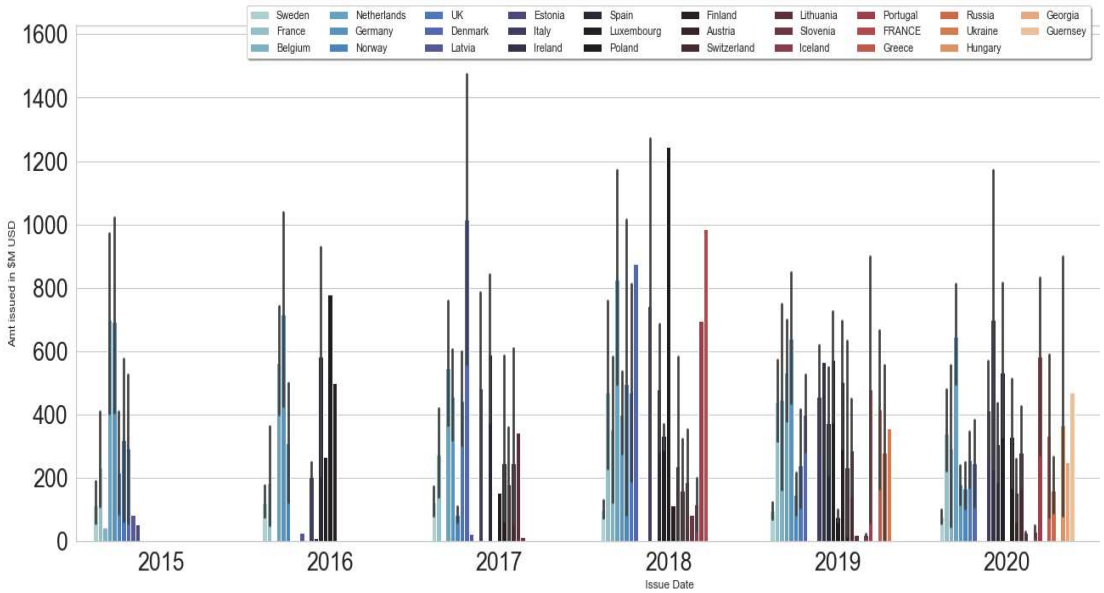


Figure 7: European 29 countries contribution to green bond market (CBI, Data)

France and Germany are the largest contributing countries from Europe

The largest issuance in the USA was issued by New York MTA USD2.021B by the Local Government in 2017 where the use of proceeds is focused towards the Transportation sector, and maturity is 2040.See Annexure 1, top issuers in N America for more details.

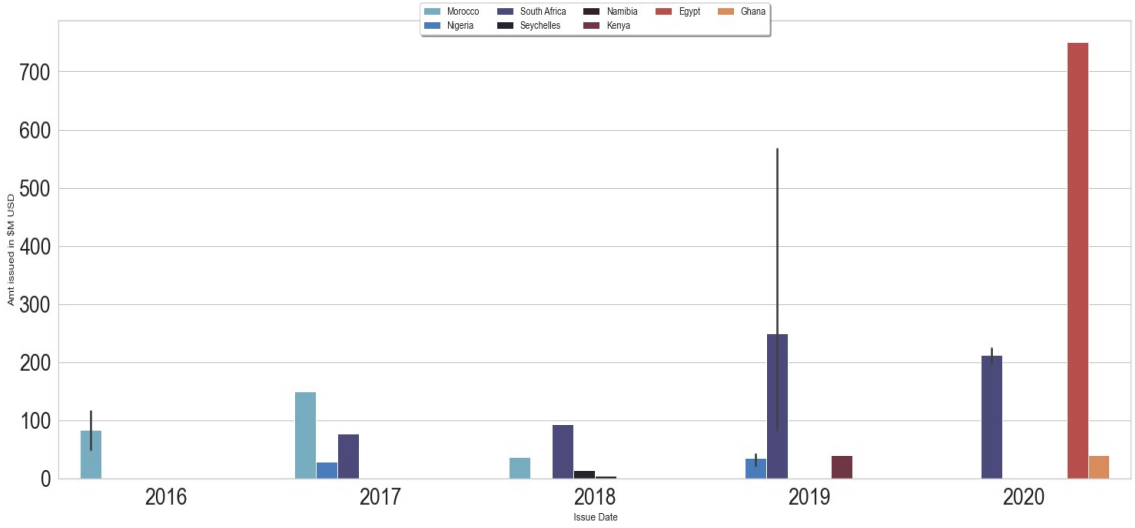


Figure 8: Africa top contributors to green bond market (CBI, Data)

Within Africa, the distribution of the funds raised by green bond issuance has been overwhelmingly concentrated in South Africa. Figure 8 reveals the share of green bonds issued by the country. South Africa leads the continent by an extremely wide margin. The top issuer from Africa is Redstone Solar Plant with amount issued of USD 566M and the use of proceeds is directed towards the Energy Sector with the issuance date being 2019 and maturity year 2036.

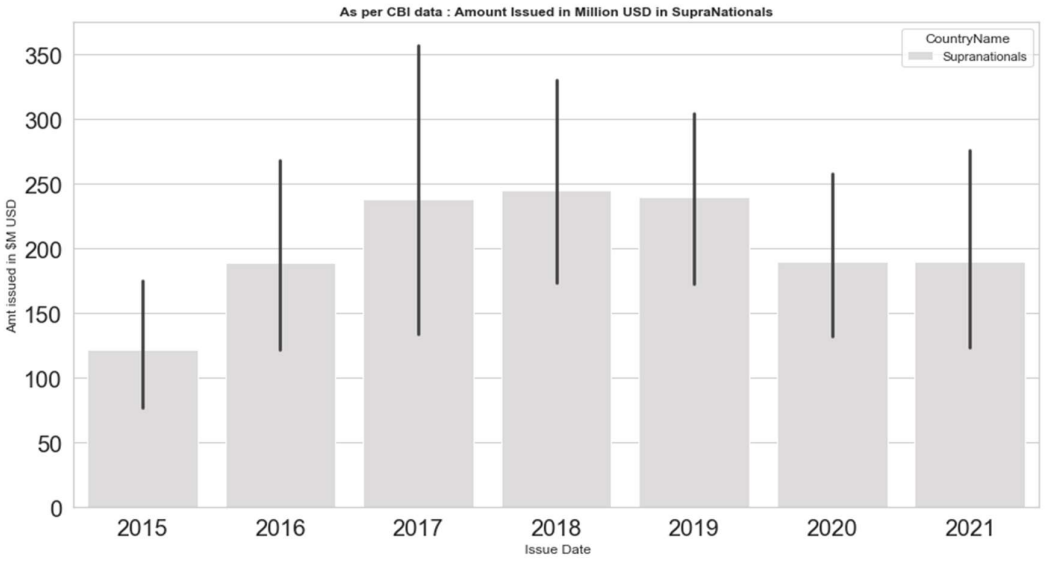


Figure 9: Top Supranational contributors to green bond market (CBI, Data)

Supranational organizations, such as the World Bank, European Investment Bank, Asian Development Bank, and International Finance corporation issued most of the green bonds. The European investment bank contributed USD 1.5B for four consecutive years from 2016-2020 where the use of proceeds is an investment in the Energy and Building sector and the maturity period being 10 years (CBI,2020a).

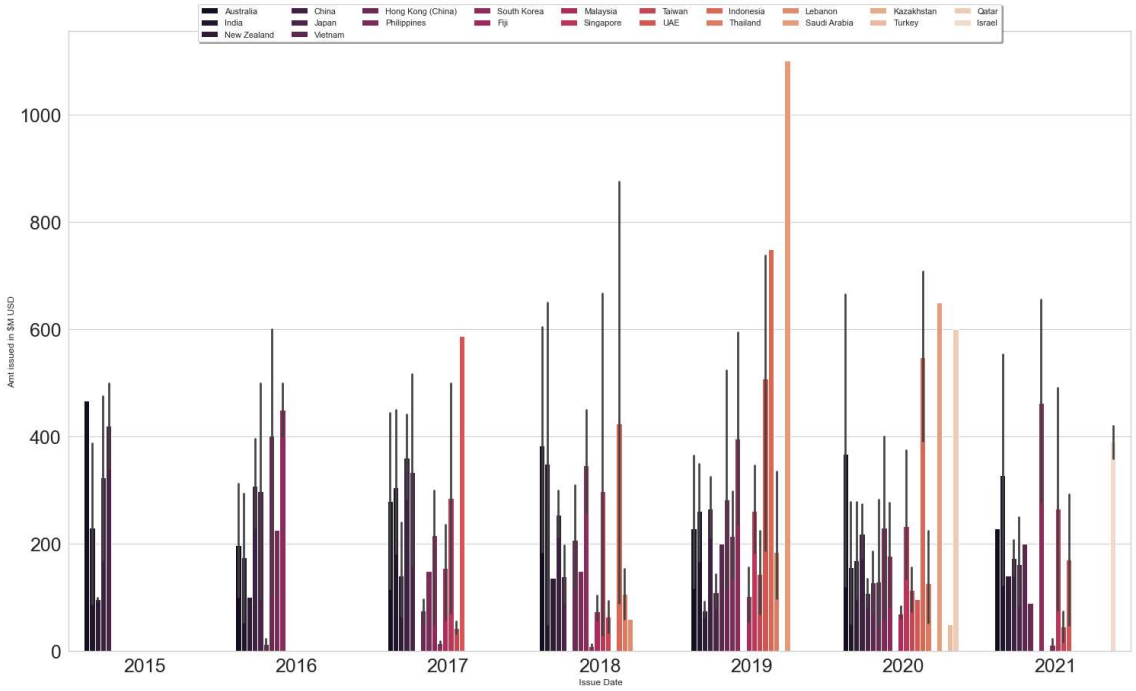


Figure 10: Asia-Pacific top Contributors to green bond market (CBI, Data)

China has led the world in kickstarting a domestic green bond market with robust policy support including clear definitions and strong regulatory guidance for green finance. (CBI,2020b). The Industrial and Commercial Bank of China (ICBC) was the largest green bond issuer in 2019, and its Singapore and Hong Kong branches issued green bonds worth a combined USD5.3B. In addition, ICBC Financial Leasing Co., Ltd., the subsidiary of ICBC, also issued USD600m of green bonds through the Hong Kong Stock Exchange (CBI,2020b). In the year 2020 Beijing Jingneng Clean Energy issued a green bond focused on Energy sector of value USD 2.11B. See Annexure 1 , top issuer in N America for reference.

4.3 Green Bond Issuer type

French green bond issuance commenced in 2012 with the first three French deals coming from local government entities Île-de France, Provence-Alpes-Côte d'Azur, and Hauts-de-France. These pioneering deals laid a solid foundation. France now boasts the largest green bond market in Europe and the third-largest global issuance to date (CBI,2020a). The most prolific contribution by the Sovereign Institutions – is the Republic of France with issuance in the range of USD 1.8B to USD 1.9B. KfW (Germany) is the most active and largest Development Bank issuer among the latter. Government-backed entities, local governments, and sovereigns account for around 40% of cumulative issuance (CBI,2020a).

Many repeat issuers are observed for Swedish local governments but are surpassed slightly by French issuers in terms of overall volume. From the figure11 we can say, local and central government, taken together, account for less than the volume placed by government-backed entities. Over a fifth of total issuance comes from state- and municipality-owned entities, a category that includes primarily financial institutions, energy, rail, and property companies. (CBI,2020a) An ABS instrument can be defined as “green” when the underlying cash flows originate from low-carbon assets or where the proceeds from the deal are earmarked to invest in low-carbon assets. Most green ABS volumes globally are backed by mortgages for homes that meet energy efficiency standards. This includes the largest single green bond issuer, Fannie Mae, in the U.S (CBI,2020a).

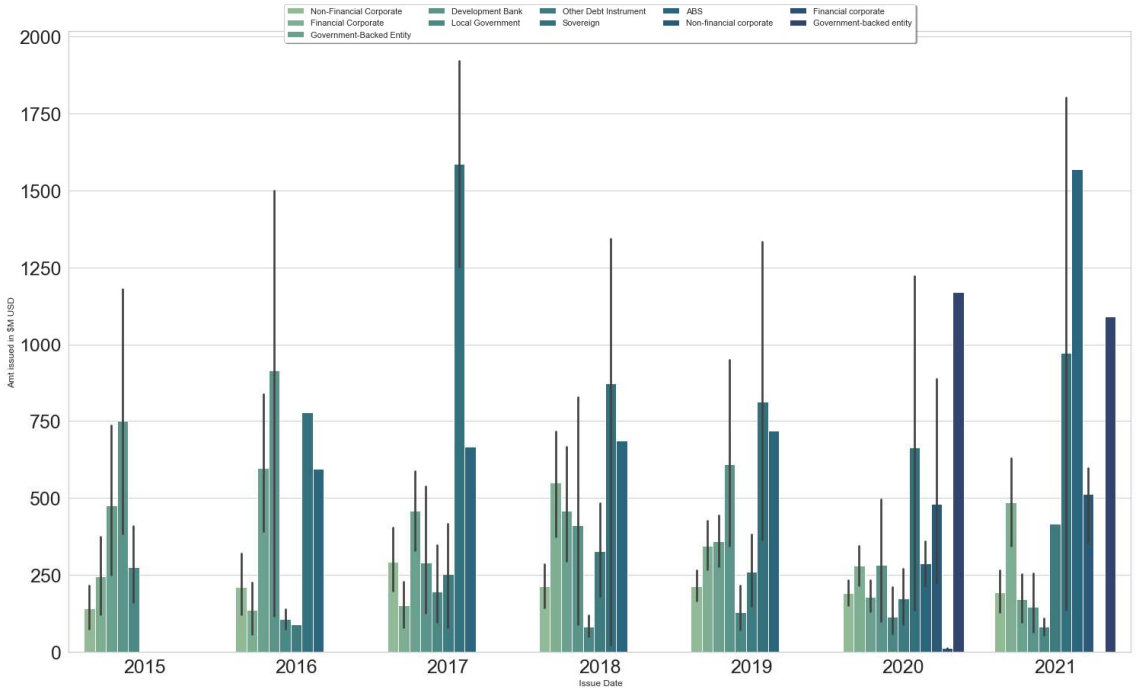


Figure 11: Issuer type in Europe (CBI, Data)

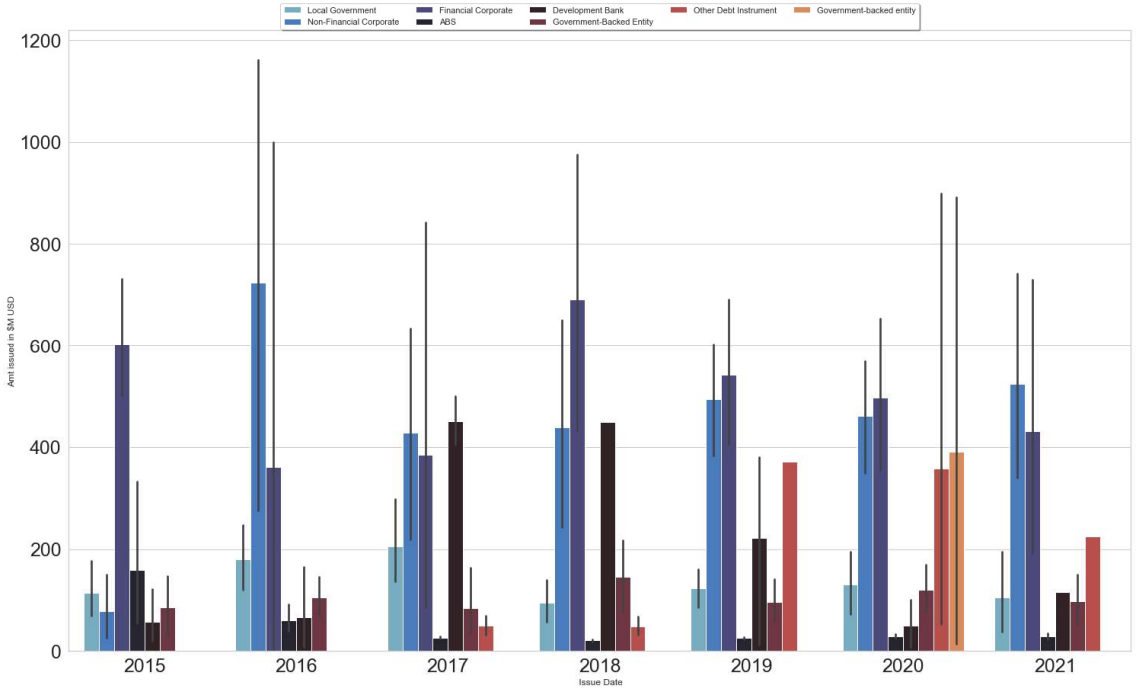


Figure 12: Issuer type in N America (CBI, Data)

North America remained broadly static on the prior year with USD61.4bn of green bonds compared to USD60B in 2019. The United States now boasts the largest green bond market in N America and the most prolific contribution by the local Government is Directed

towards the Transportation sector issued by New York MTA with total issuance of USD 3.7b and Los Angeles County MTA –with total issuance of USD 1.7B. Apple INC, Equinix, and Southern Power company are the largest non-financial corporates issuers. Toyota has issued a significant amount of proceeds directed towards the transportation sector issued by ABS.

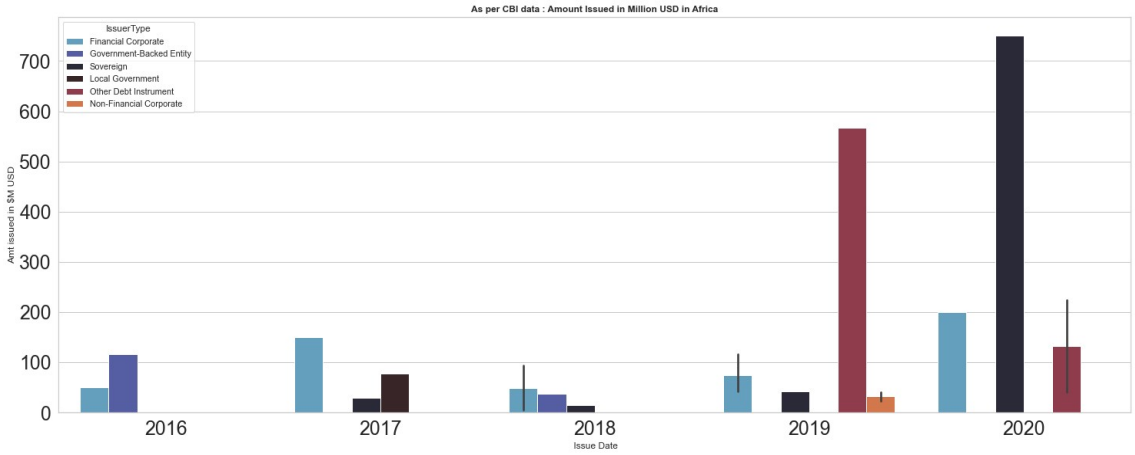


Figure 13: Issuer type in Africa (CBI, Data)

South Africa is the country that has issued the comparatively greener bond, Nigeria in second place. The top issuer was Financial Corporate focused on Energy, water, and buildings There is also one top Sovereign issuer from Egypt (Arab Republic of Egypt), which has issued USD750M with a 5-year tenure issue date of 2020 (CBI,2020a) .

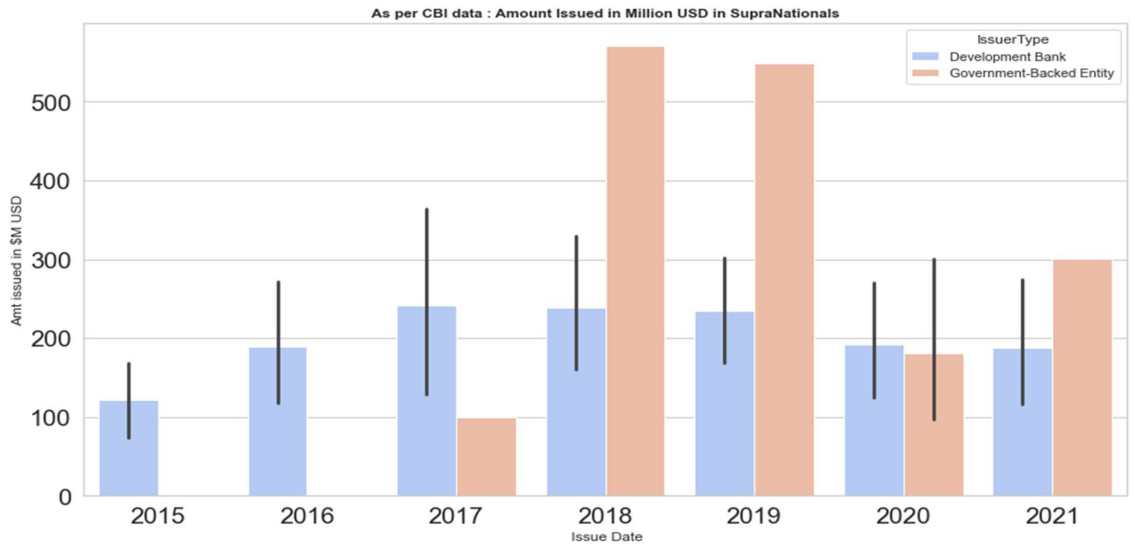


Figure 14: Issuer type by Supranational (CBI, Data)

European Investment Bank pioneered the Green Bonds market by issuing the world's first Climate Awareness Bond (CAB) about 10 years ago. Since then, more than EUR 18bn have

been issued, and CAB proceeds have helped finance 160 renewable energy and energy efficiency projects all over the world (EIB,2020).

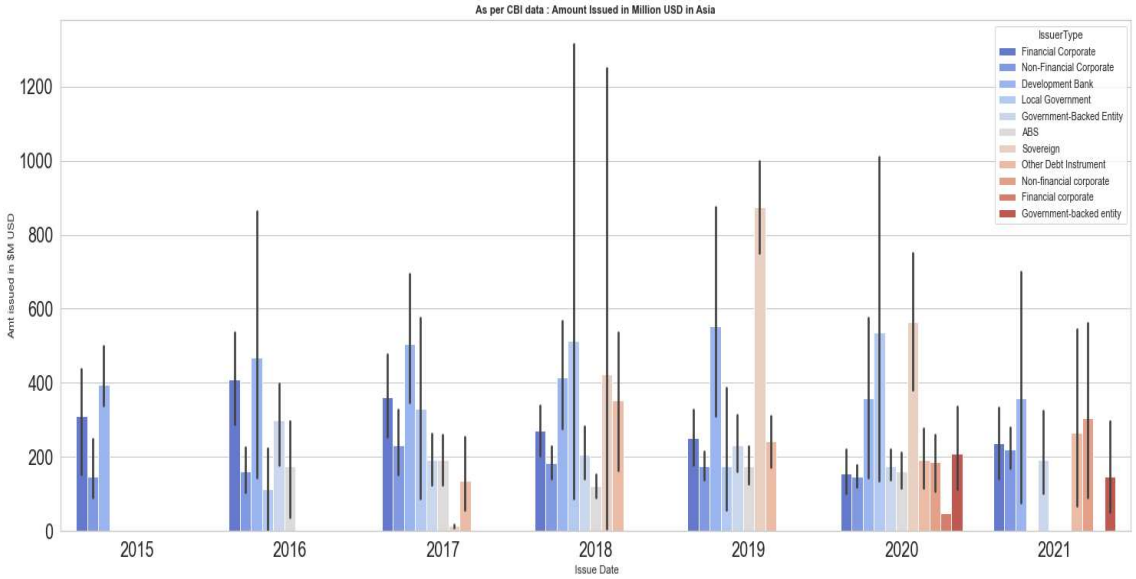


Figure 15: Issuer type in Asia-Pacific (CBI, Data)

China is the largest green bond issuer from the Asia-Pacific region with total sum issuance of since 2015 USD 84B. Transport was the most funded sector (35 percent) by offshore green bonds, closely followed by low carbon buildings at 32 percent. The Industrial and Commercial Bank of China (ICBC) was the largest green bond issuer in 2019. Asset-backed securities (ABS) volumes tripled in 2019 rising to USD7.2bn (RMB50.3bn) and from 5% to 13% of the global total (CBI,2020b). Also, the most funded project types are low carbon transport and water infrastructure. See Annexure 1, top issuers for more details.

4.4 Tenor

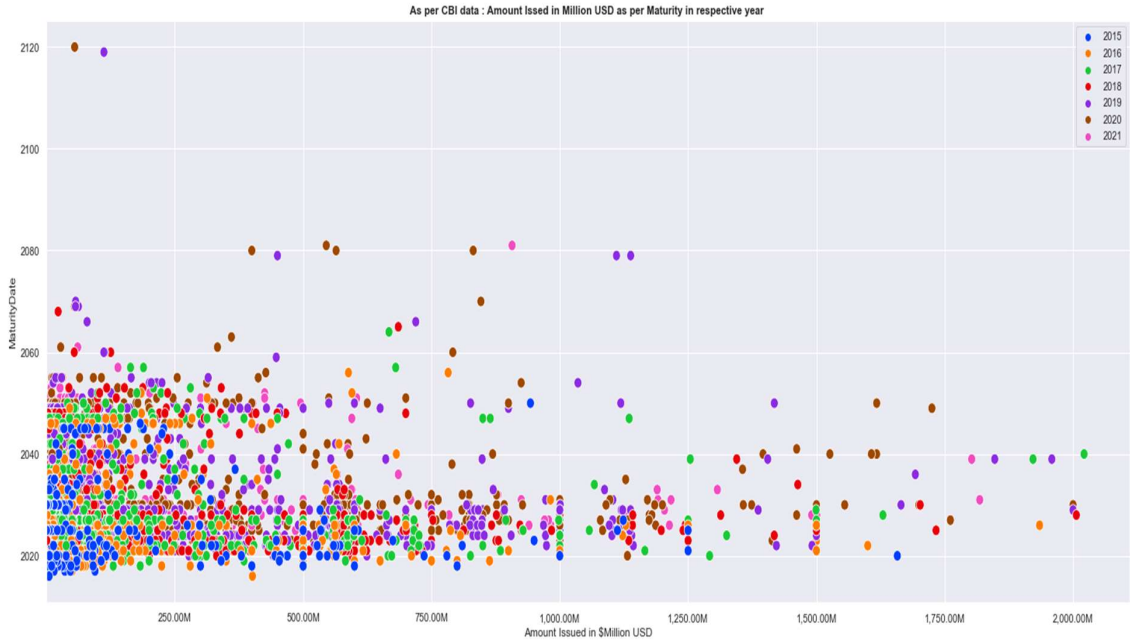


Figure 16: Green Bond Tenor (Most new green bonds have tenor of <10-years)

From the figure, the range of the greenest bond amount issuance lies between USD 250M to USD 750M and since 2015 the maturity date has been increased from 5 years to mostly 10 years. About roughly 60% of the 2020 green bond volume had a maturity of up to 10 years, and the rest 40% having a 5-10-year maturity. From the data acquired the 5-10-year bonds, originated from financial and non-financial corporates with significant amounts as also seen in previous figures. Also, from the observations, the longer-dated (10-year+) paper mostly originated from the public sector. Government-backed entities, sovereigns, and utilities categorized as nonfinancial corporates are the key issuers. There are a noticeable 5% decrease in the 0-5-year bracket and 3% increases in each of the 10-20- and 5-10- year intervals, both of which are explained by the inclusion of more sovereign bonds.

4.5 Use of Proceed

The scatter plots below give a holistic view of our data. The data was sorted annually and grouped; each color represents different years. The sector mentioned for each observation in the data has use of proceeds directed towards Energy, transportation, buildings, water, land use. The Use of proceeds directed towards Energy, Buildings, and Transport were respectively the three largest UoP categories, contributing 85% to the total in 2020 as shown in the scatter plot below. Sovereigns and government-backed entities supported 26% year-on-year growth in Transport, with each contributing USD34B (CBI,2021). A significant amount of green bond issuance from Europe is directed towards the Energy, Building, and Transportation sectors. As noted, large, long-term infrastructure projects – such as transport investments – are least likely to be impacted by the ramifications of a global pandemic, particularly in the short term and in a prevailing low-rate environment. Almost half of the Transport allocations of government-backed entities originated from France (USD14.8bn)

China was the second-largest source (USD3.8bn), with eleven separate metro projects raising cash in the green bond market. Investments directed towards Renewable Energy exhibited 19% growth compared to 2019. Almost half of that (46%) came from financial and non-financial corporates, including energy companies, and others such as Telecom provider Verizon that issued its second green bond in September, a USD1bn 10-year. The buildings category remained static at around USD76bn. Private sector confidence to begin new construction projects – as well as the uncertainty surrounding the occupancy rates of existing real estate – will naturally have been impacted by the COVID-19 pandemic. Further, bank lending will have tightened considerably for all types of private sector loans, and a large part of this category comes from financial corporates**.**

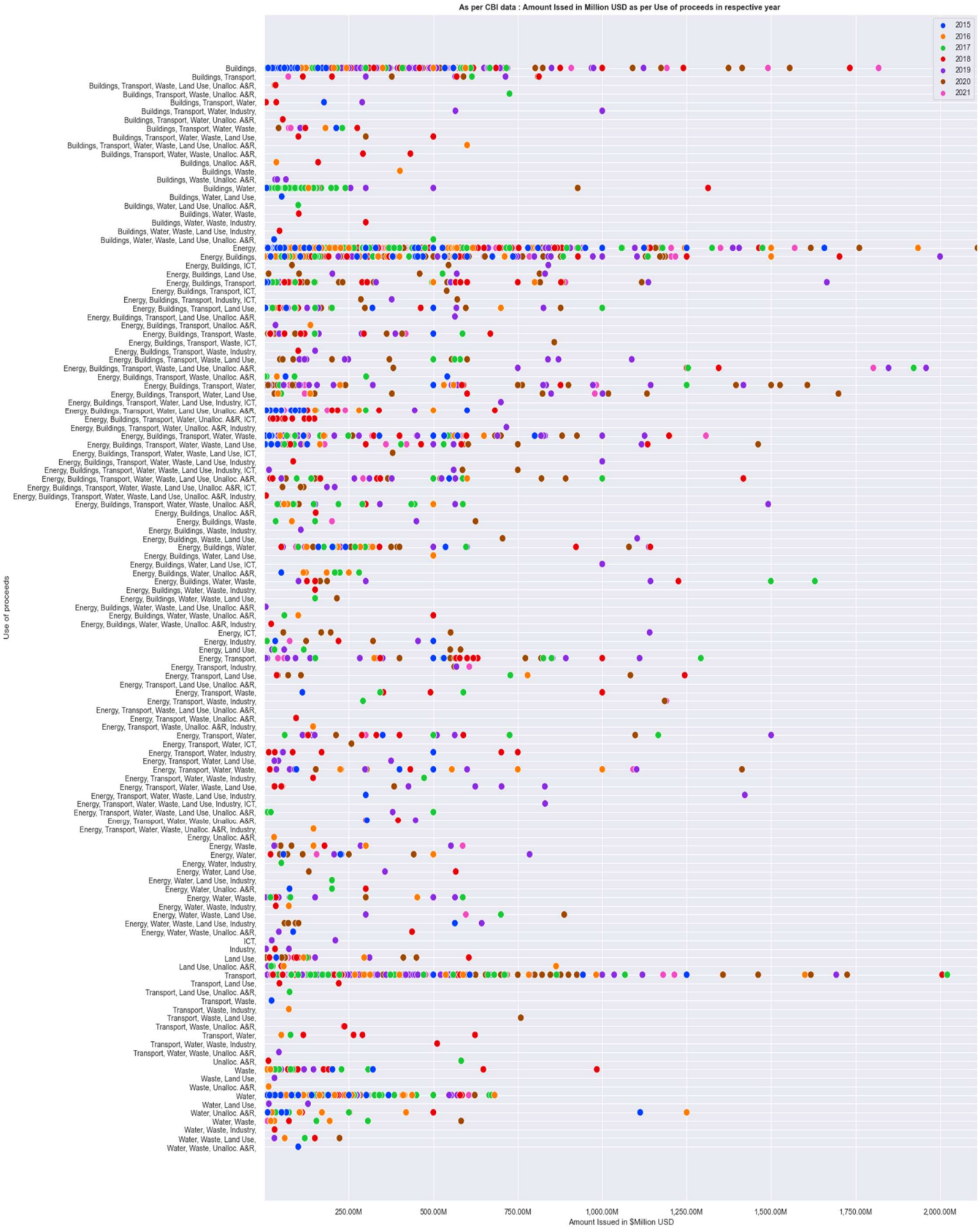


Figure 17: Use of proceeds in various sector from 2015-2021(CBI, Data)

4.6 Circular Economy projects across Sector

In this part, we perform hypothesis tests to gain further insight into the potential difference between various attributes, based on the data we sorted. The dataset used for the below analysis is based on the identified 27 issuers (found in Annexure 3).

Hypothesis tests for means and medians: Firstly we perform a two-way ANOVA to estimate how the mean of a quantitative variable (Amount issued in USD) changes according to the levels of two categorical variables (Region, Sector). To determine whether each main effect and the interaction effect is statistically significant, we compared the p-value for sector and region terms to a significance level to assess the null hypothesis. If Ho (null hypothesis) is true that means Sector and Region has no effect on the green bond amount issued in USD. A significance level of 0.05 is considered which indicates a 5% risk of concluding that an effect exists when there is no actual effect. Figure 21, There is a significant effect of the sector on the issuance of Green Bond amount in USD and there was no statistically significant difference in mean interest in the region (p= 0.544). On the contrary, there is an effect of Institution type and Region on the dependable variable at p<0.001.

Tests of Between-Subjects Effects

Dependent Variable: AmountissuedinUSD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3.012E+19[a]	14	2.151E+18	17.960	<.001
Intercept	1.418E+19	1	1.418E+19	118.378	<.001
Region	1.535E+17	2	7.673E+16	.641	.544
Sector	2.627E+19	11	2.388E+18	19.936	<.001
Region * Sector	.000	0	.	.	.
Error	1.437E+18	12	1.198E+17		
Total	4.328E+19	27			
Corrected Total	3.156E+19	26			

a. R Squared = .954 (Adjusted R Squared = .901)

Tests of Between-Subjects Effects

Dependent Variable: AmountissuedinUSD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2.905E+19[a]	10	2.905E+18	18.553	<.001
Intercept	1.379E+19	1	1.379E+19	88.103	<.001
Institutiontype	1.573E+19	6	2.621E+18	16.742	<.001
Region	1.158E+19	3	3.861E+18	24.658	<.001
Institutiontype * Region	1.099E+19	1	1.099E+19	70.178	<.001
Error	2.505E+18	16	1.566E+17		
Total	4.328E+19	27			
Corrected Total	3.156E+19	26			

a. R Squared = .921 (Adjusted R Squared = .871)

Figure 18: SPSS Two -way Anova Results

In these results, the predictors explain 95.4% of the variation in the response. The adjusted R^2 is 90.1%. The actual result of the two-way ANOVA – namely, whether either of the two independent variables or their interaction are statistically significant – is shown in the Tests of Between-Subjects Effects table, as shown above, there is no interaction between sector and region term. We can see that there is a statistically significant difference between Institution type and Region at P<0.001.

Hypothesis Tests Concerning the Variances: As per the Two-way Anova test we came across the conclusion to reject Ho as the p-value is smaller than .05, for the sector. It means that at least one of the means is not the same as the other means. We did a post hoc - Scheffe test considering the dependent variable: AmountissuedinUSD and the independent variable: Sector. In the data we have the n value for the sector varies and there are few instances where the N values are less than 2, to execute the Scheffe test we need a minimum of 2 cases per group. So, all the instances which are less than 2 cases were compiled together as one group under OTHER as seen in the figure below.

Between-Subjects Factors

		N
Sector	NO SPECIFIC SECTOR	4
	OTHER	8
	POLLUTION PREVENTION AND CONTROL	2
	WASTE MANAGEMENT	6
	WASTE MANAGEMENT/ WASTEWATER MANAGEMENT AND WATER	3
	WASTEWATER MANAGEMENT AND WATER	4

Figure 19: The N value for sector subgroups

The results contradict our previous conclusion from the Two-way ANOVA test once we create the OTHER group in the sector attribute, the P-value we get is $0.431 > 0.05$, so we accept the HO, i.e., there is no effect of Sector on the amount issued in USD variable, these groups are not significantly different.

Tests of Between-Subjects Effects

Dependent Variable: AmountissuedinUSD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	616944002921934850 0.000[a]	5	123388800584386970 0.000	1.021	.431
Intercept	770226507247213160 0.000	1	770226507247213160 0.000	6.372	.020
Sector	616944002921935360 0.000	5	123388800584387072 0.000	1.021	.431
Error	253859770665804920 00.000	21	120885605078954726 0.000		
Total	432839791305533600 00.000	27			
Corrected Total	315554170957998400 00.000	26			

a. R Squared = .196 (Adjusted R Squared = .004)

Figure 20: The output table for Scheffe test using SPSS

The results are indeed contradicting, and the reason for it is due to uneven and constrained data. Therefore, from the sample of our data we can say that the means of subgroups are statistically significantly different from each other, as seen below in the figure, but as per the statistical test conducted significant differences between the distributions of green bonds as per sector cannot be inferred as per our data.

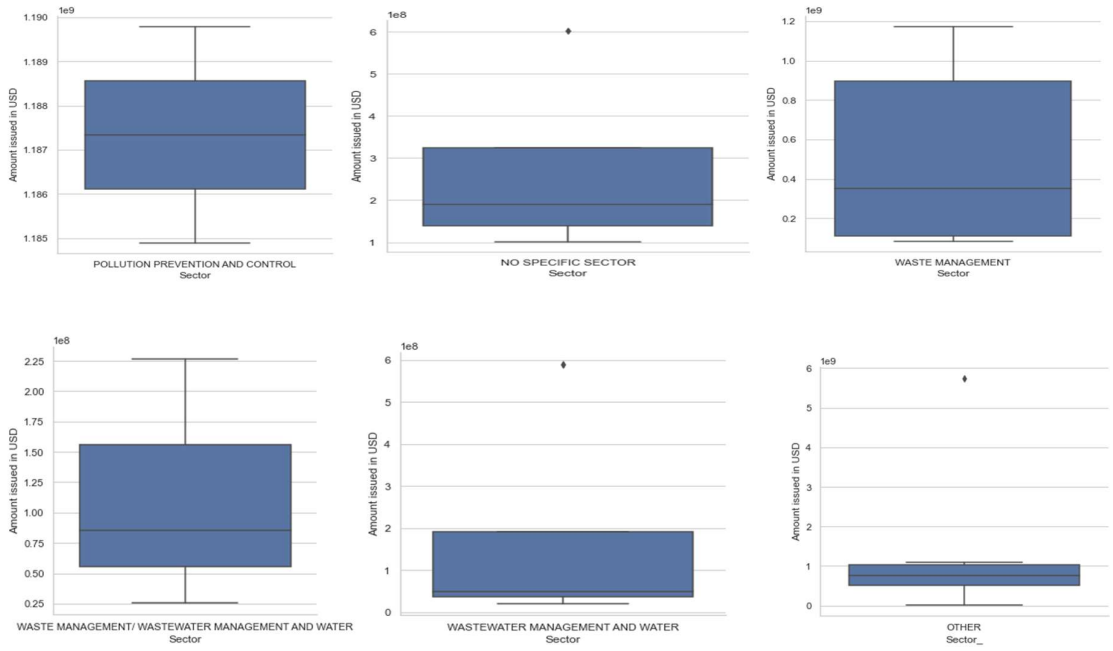


Figure 21: Box plots of sectors

To address the RQ1, we did thorough reading about the information provided in the second party opinion review of the 27 issuers we identified from the overall data. Annexure 2 shows a detailed overview of the circular economy growth potential in key sectors. The categories mentioned in the annexure table are based on a qualitative assessment of second party opinion reviews and annual overview drafts of respective companies, the table represents the information and project type considered under each category as per second party opinion reviews. The second-party opinion provides an assessment of the issuer's green bond framework, analyzing the "greenness" of eligible projects/assets. Some also provide a sustainability "rating", giving a qualitative indication of aspects of the issuer's framework and planned allocation of proceeds (CBI,2018). The table aims to provide a rough indication of what kind of projects or production activity issuers think is inclined towards their circular economy goals. Indeed, more in-depth analysis by sector would be required to draw a concrete pattern related to investments or any other financial decision focused on the circular economy.

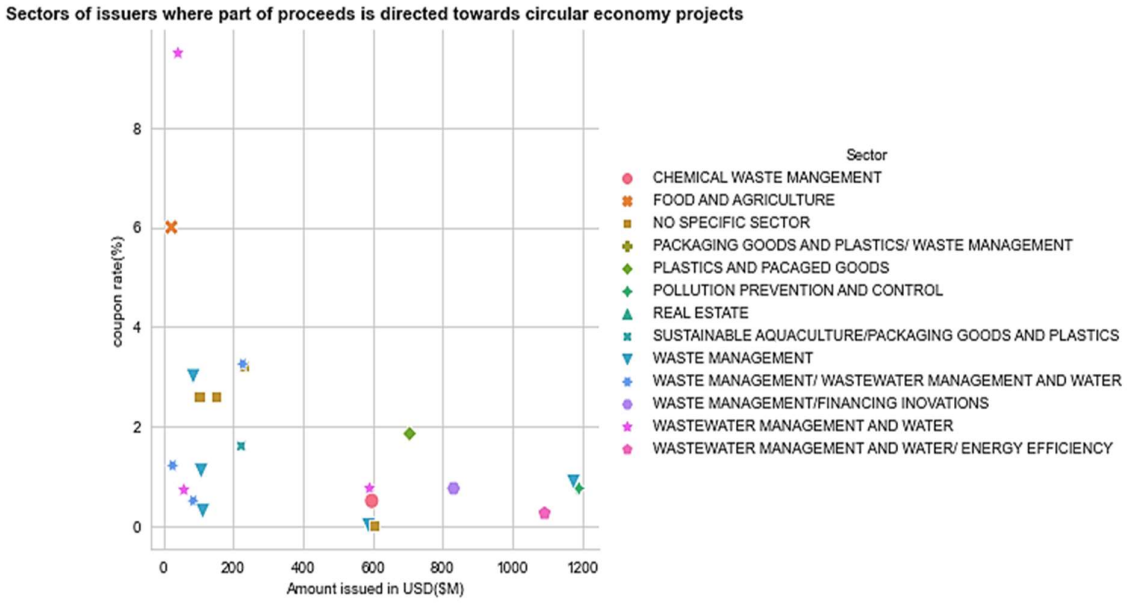


Figure 22: Relationship between Amount issued for Respective sector vs coupon rate (%)

From the analysis, focused on waste management and resource efficiency investments inclined towards the waste hierarchy; The hierarchy which includes preventing, reuse, recycle, recover, disposal well-known framework illustrating different waste management options from prevention to disposal roughly in order of their relative environmental impact (CBI,2020c). From Figure 23 we can see that under the Circular Economy criteria a significant number of projects financed using green bonds typically fall under the recycling and recovery levels of

the hierarchy followed by wastewater treatment projects. It was reported in the literature that corporate issuers also use green bond financing to fund the acquisition of new waste treatment facilities, as well as to purchase other companies that for example operate existing recycling plants (CBI,2020c).

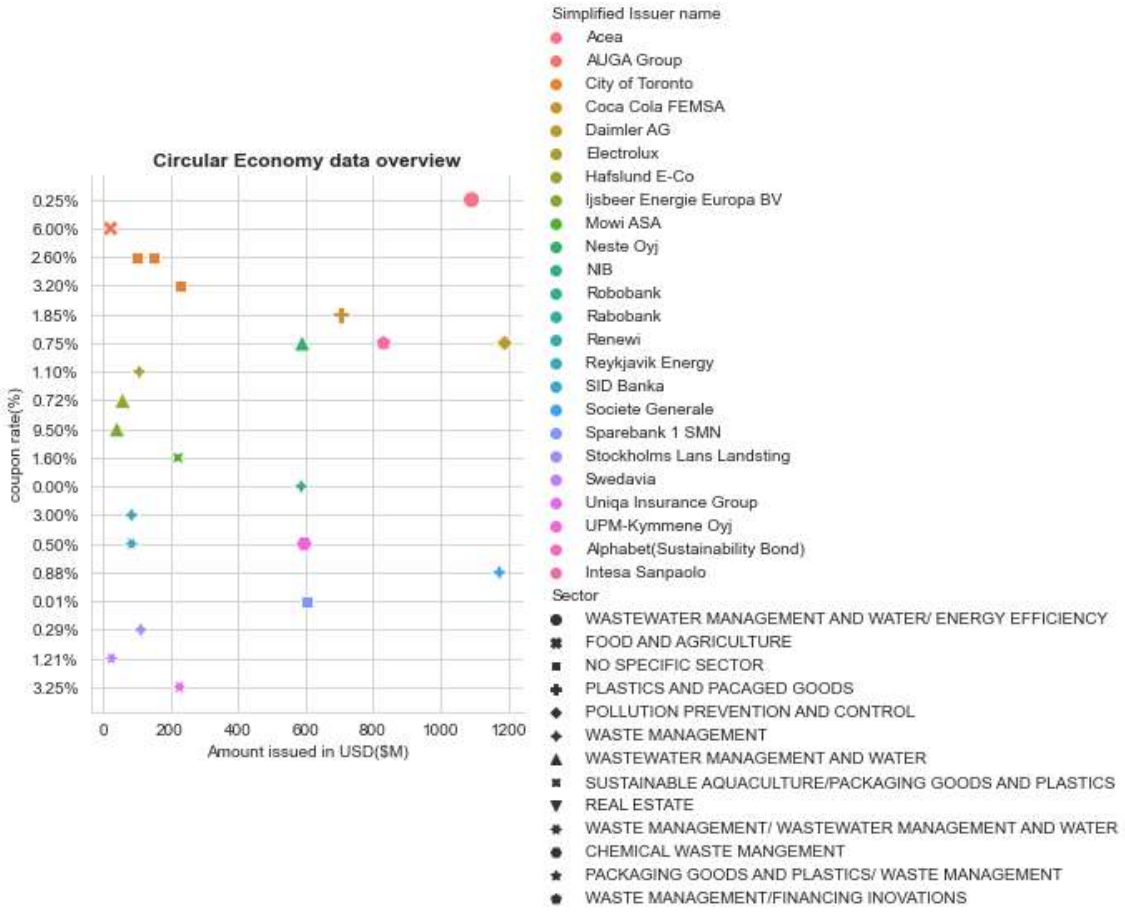


Figure 23: Overview of CE data (CBI, data)

The above figure describes the sector and the issuer information in form of points. Renewi (UK) is an example of a pureplay waste management corporate issuing green bonds. Its latest deal of green bond is from July 2019 was a EUR 75M with a coupon rate of 3% and tenor being 5 years. They have issued other green bonds which have financed projects related to recycling waste into usable products; treating contaminated water and soil because of hazardous waste exposure; treating organic waste by converting it into energy or fertilizer; and reducing the emissions from transporting waste (CBI,2020c). Renewi's goal as a company under its Green Finance Framework will contribute to its aim to promote a sustainable society in the general and circular economy through extracting value from waste.

Other companies working on diversifying their materials base and designing CE compatible products include Neste's whose target related to circular economy solutions is to be in forefront of renewable products by 2025 by using entire waste and residual material, from the current 80%. Which includes a gradual reduction in the use of palm oil in the production of renewable diesel from 20% in 2020, and replacing virgin vegetable oils with waste and residues. Neste is also diverting its focus towards chemical recycling, aiming to utilize waste with no or low value in mechanical recycling. Another example: UPM-Kymmene Oyj, wherein the second party opinion reviews they mentioned that as part of circular economy projects partial investments will be directed towards bio-refinery facilities, stating that their biorefinery will produce a range of 100% wood-based biochemicals which enable a switch from fossil raw materials to sustainable alternatives in various consumer-driven end-uses.

CE also entails business model innovation. For example, Rabobank will be using part of its proceeds towards green real estate. As part of Rabobank's new Sustainable Finance Framework. The proceeds of this Green Bond may be used to allocate funds to the loan portfolio of new and/or ongoing renewable energy projects. The main goal of this financial institute is to move its entire real estate portfolio towards energy label A. By 2030, the bank aims for its real estate portfolio to have obtained energy label C or higher. Through this project, Rabobank contributes to climate mitigation reducing greenhouse gas emissions through e.g., expanding the usage of renewable energy in the built environment, energy efficiency in buildings, and advocating for the important shift towards a circular economy.

There are ample examples globally of firms embracing CE and green bonds. For example, Italian and Dutch banks Intesa Sanpaolo and ING: Intesa Sanpaolo dedicated a circular economy credit facility for the period 2018-2021, in close partnership with the Ellen MacArthur Foundation, of which the Bank has been the sole Financial Services Global Partner since 2016 (Intesa Sanpaolo,2020). Norwegian seafood producer Mowi anticipates allocating 60% of the use of proceeds to Sustainable Aquaculture and the remainder mostly to Water and Wastewater management. Zero to 20% of the proceeds will go to refinancing investments in resource-efficient products and solutions, such as new net and packaging designs focused on reducing, recycling, and replacing plastic raw materials.

Philips has developed the Green Innovation Bond as part of its sustainability strategy. Dutch electronics conglomerate Philips, issuance of EUR 750 million 0.500% Green

Innovation Bonds for the period 2019-2026 in a collaborative effort with Rabobank as part of its sustainability strategy. The proceeds will be used to finance green innovation, the transition to the circular economy, and becoming carbon neutral in the coming years (Robobank,2019). From our research typical examples of assets and projects include – circular economy adapted products by integrating recovered and/or reused resources, research and development activities of materials which can be considered under eco-efficient category; use, reuse and recycle post-consumer waste products; waste-to-energy facilities; improve effectiveness and efficiency of resources consumption, within a company's operations or along its supply chain; waste-water recycling and optimizing water management in operations.

4.7 Ratio of green bonds addressing CE

As per our qualitative and quantitative research, to determine the impacts of green bonds in terms of various issuers, the environmental performance and engagement towards circular economy projects are usually not possible as it is hampered by important data limitations. While one would ideally need detailed information on the environmental impacts, the percentage of proceeds, the performance of investment projects over time, what kind of projects are considered under the circular economy category. But this information is seldom disclosed as reporting and external review is not mandatory in any guidelines, although considered as a best practice.

For research Q2, after going through the 771 unique observations, due to no second party opinion reviews for all the observations, we came across roughly 400 second part opinion reviews where partial use of proceeds is directed towards circular economy was mentioned by the issuer 27 companies were observed which mentioned circular economy in their second party opinion reviews. Indeed, the circular economy financing market is taking off, and even if the recent growth in financing is promising, far more capital and activity will be needed to scale the circular economy and fully seize the opportunity it presents. From our analysis with the available data, we can say the ratio of green bonds addressing circular economy is about 10% to 20% on a higher estimation.

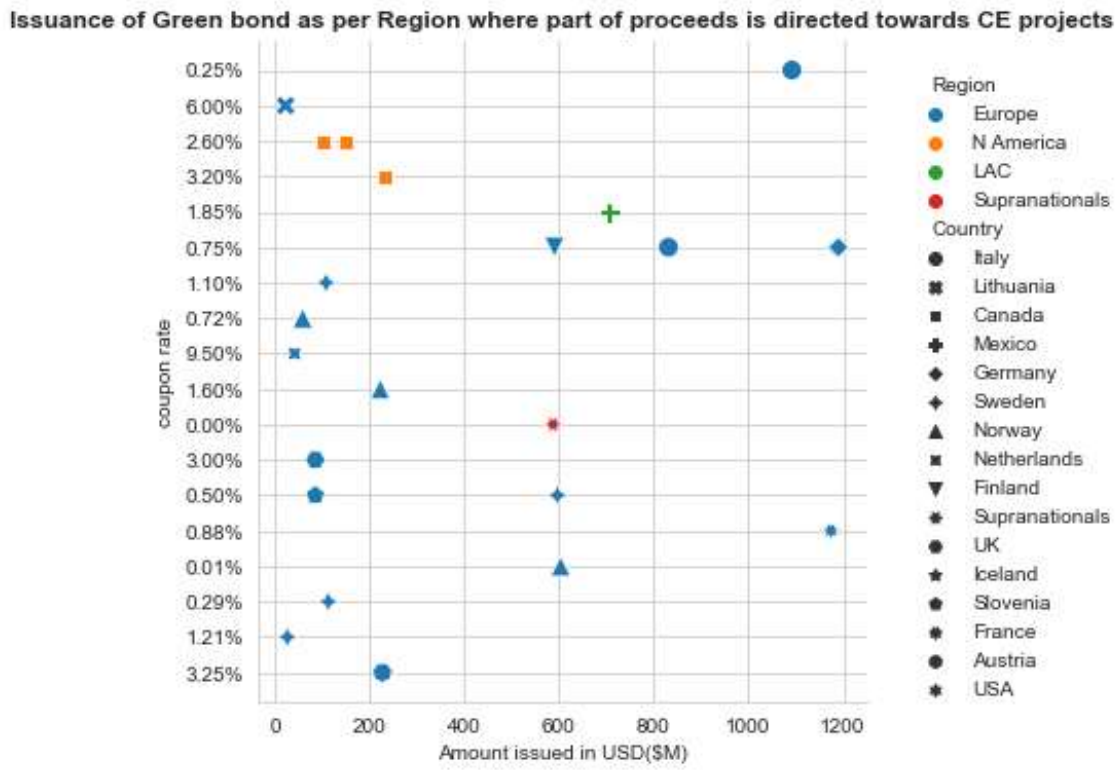


Figure 24: Europe leading the way to circular economy investment (CBI, Data)

From figure 25 under the region category, Europe is currently setting its green bond standards as part of broader measures to spur the take-up in circular economy investments via green bonds followed by North America. As green bond proceeds are managed and allocated on a portfolio basis. Until full allocation, the issuer will ensure proceeds will match or exceed the number of loans for eligible projects as per their company, so due to lack of information provided in the issuance reporting about the percentage of proceeds directed specifically towards the circular economy projects it is not possible to know the total amount of investments in USD invested by Europe or any other region just in circular economy projects, it can indeed be questioned we can be explored in future in reference to this thesis. The project which is financed under the circular economy category is inclined towards waste management and wastewater treatment from the data we captured. The preceding plot gives an overview of the sector as per the issuer.

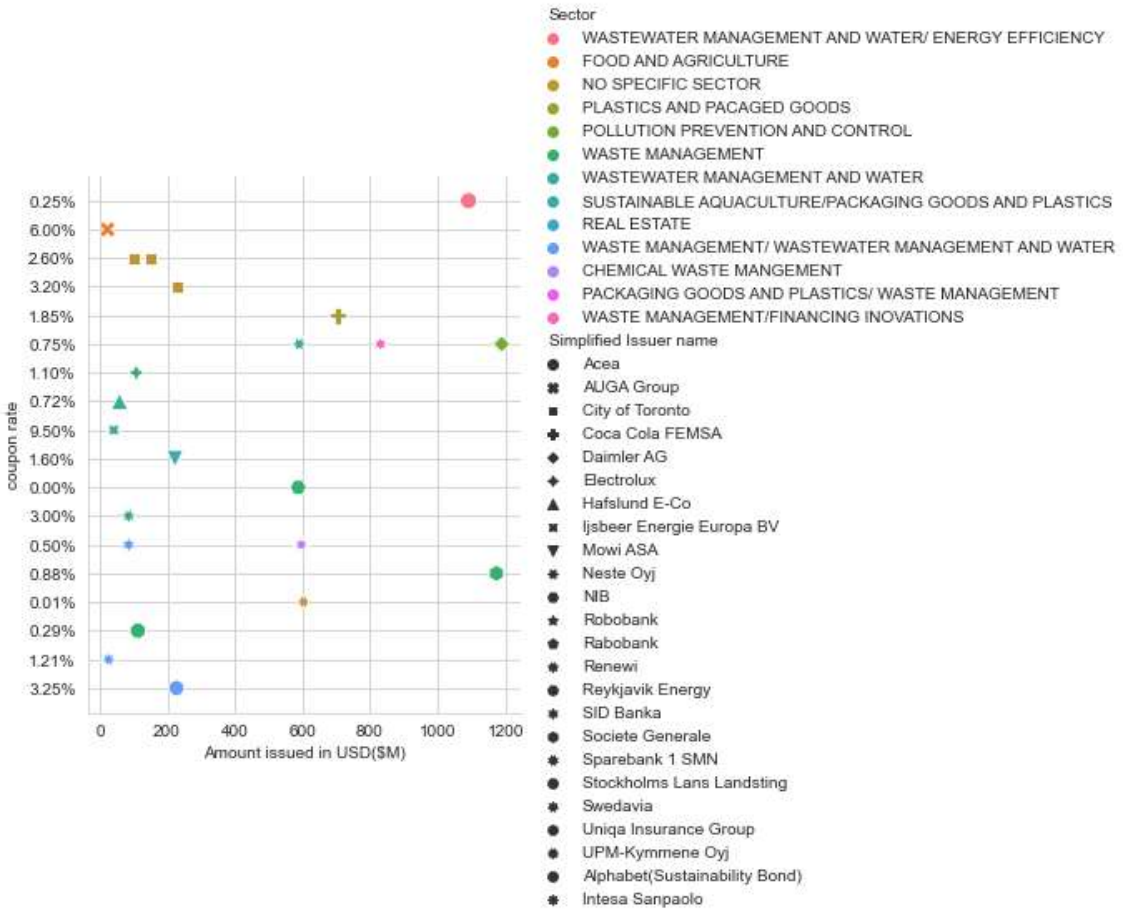


Figure 25: Sector overview for CE projects (CBI, Data)

Every issuer intends to contribute to the company's green and sustainability innovation strategy and ongoing sustainability projects and developments as part of the circular economy. The proceeds of the green bond are invested in various sectors, but the sectors mentioned above correspond to the circular economy projects categorized under the above sectors as per the second party opinion reviews.

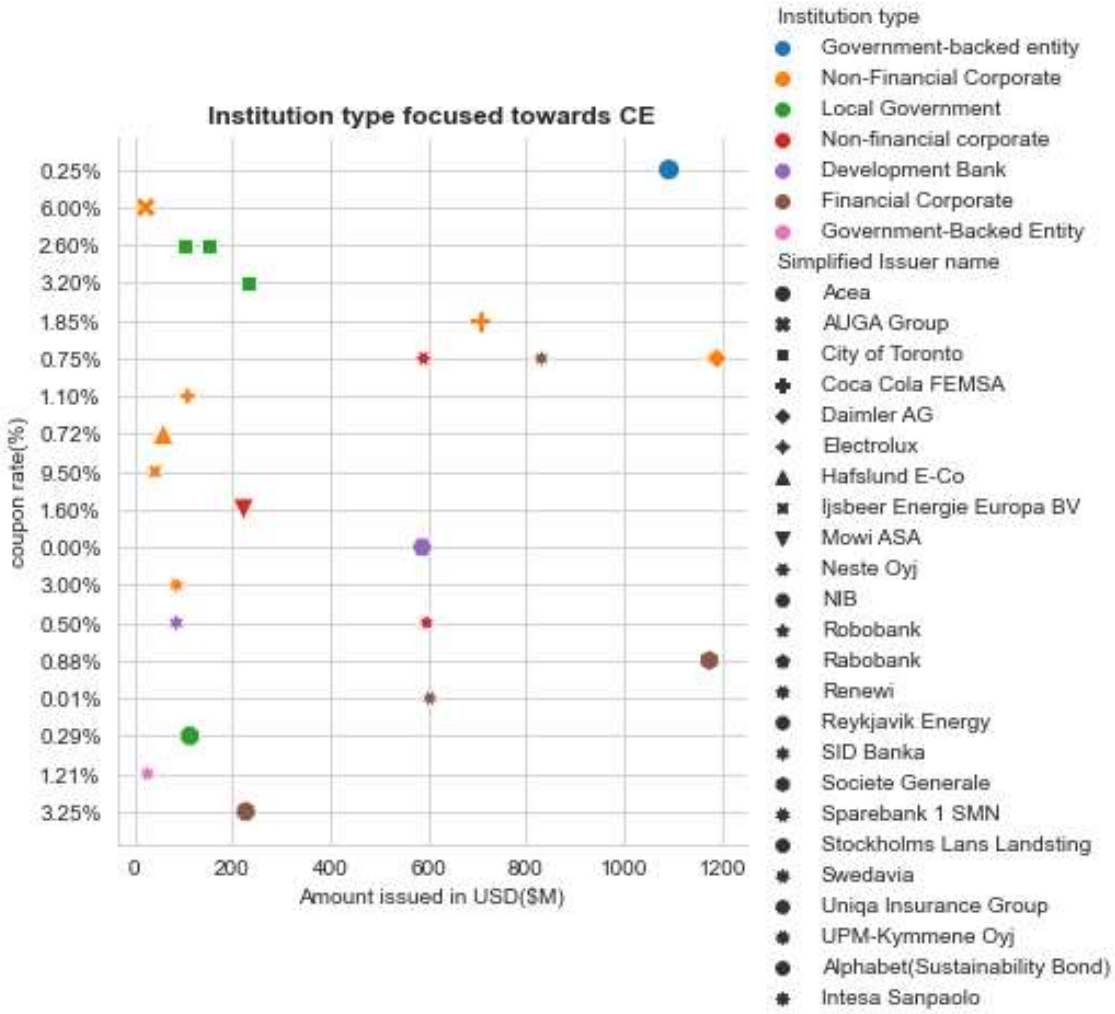


Figure 26: Institution and Issuers overview

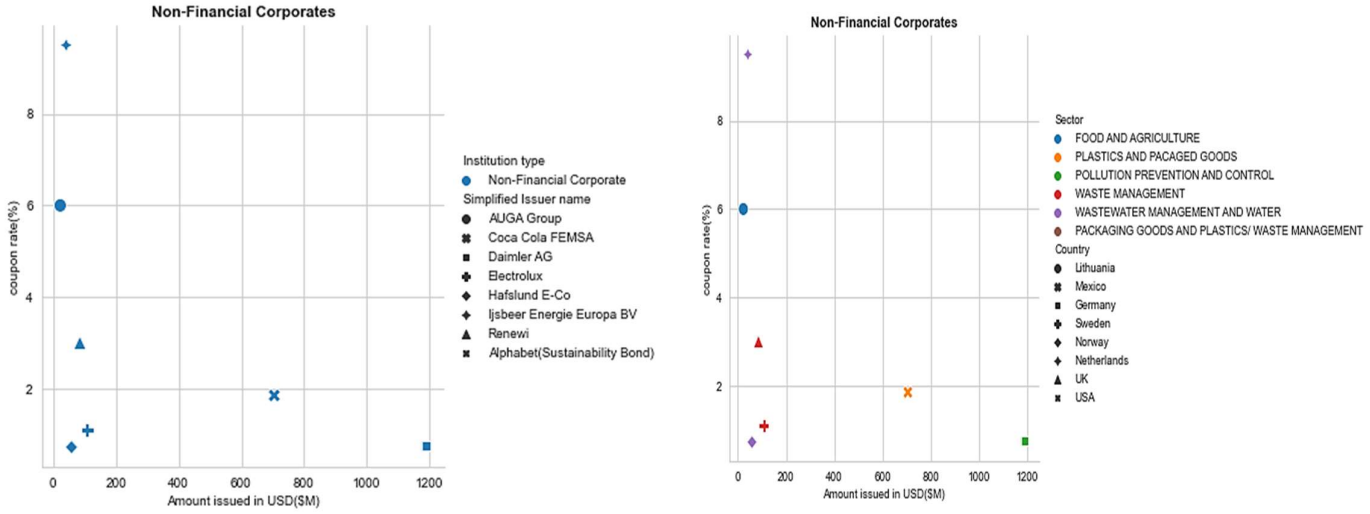


Figure 27: Non-Financial Corporates overview

Non-financial corporates - seem to be more informed about circular economy aspect where investments are directed towards diversifies sectors.

Chapter 5. Discussion

Our research shows that most authors focus on the interrelationships among the circular economy and finance but very few focus on green bonds as a financial instrument. For this reason, using this research as a medium we tried to understand how we can make investors divert more money towards circular economy projects. Governments alone cannot finance our Sustainable Development Goals. Private capital is essential. Long-dated, income-generating projects are well suited for financing through loans or green bonds (VanEck,2020). The growth of the green bond market reflects this opportunity, allowing investors to potentially achieve both sustainability and investment objectives, without having to compromise on either.

The speed at which green bond markets develop and invest in CE projects is more than what has usually been observed hinges on many variables, including policy and regulations. From our observation, both businesses and the financial sector perceive difficult barriers and see the other as responsible for failing to play their expected roles. For instance, financial sectors' main arguments corresponding to circular economy projects is that applying a new business model or applying new technologies are inherently risky and therefore often not bankable. One of the main challenges of financing the circular economy is the risk and its perception and assessments by various players.

From the quantitative analysis, we observed that financers often struggle to quantify linear risks and fail to reward circular business models (European Comission,2019). To understand the risk parameter, it is crucial for financiers and investors to understand the differences to be able to correctly value the business model and its longer-term economic potential.

Currently, introducing circular products is hard because they compete with products derived from ‘tax-free’ pollution. For instance: The existing taxation system penalizes labor-intensive activities, including many circular activities (e.g., repair, maintenance, reuse, recycling, and remediation services), in contrast with the resource-intensive activities of the linear economy or the (robotized) manufacture of new products (Vence et al, 2021). Virgin raw materials are too cheap to acquire and too cheap to dispose of. At the same time, high labor costs hold back labor-intensive R&D efforts as well as service-oriented business models. This inhibits the transition. The current tax barrier could be turned into a catalyst for a circular economy by applying the ‘polluter pays’ principles and shifting taxes from labor to

consumption and natural resources, all with the end goal to enable growth based on human capital rather than the extraction of natural resource (Goovaerts et al, 2018)

5.1 Creating Circular Economy Guidelines

While doing quantitative analysis we observed it is very crucial to have a well-defined methodology that will enable the financial industry (and other stakeholders) to identify circular economy investment opportunities and to evaluate and measure how relevant an entity's circular economy project is to that entity's transition to a circular business model. Recently, Intesa Sanpaolo created a 5 billion euro credit facility dedicated to the circular economy – in close partnership with the Ellen MacArthur Foundation – to support SMEs and corporates with innovative and transformational projects that incorporate the principles of the circular economy and tracks relevant targets and progress towards KPIs (e.g. plastic recycling targets) the bank also has a program that supports its customers through loans and investments dedicated to a circular economy (Intesa Sanpaolo,2020).

The "Circular Economy Finance Guidelines", ABN AMRO, ING, and Rabobank launched joint circular-economy finance guidelines internationally, inspired by the ambition to create a common framework for financing the circular economy worldwide. The FinanCE Working Group was set up in 2014 by PGGM (Pension Fund for Care and Well-Being) with other players and has close links to the Ellen MacArthur Foundation. These guidelines are voluntary which recommend transparency and disclosure and promote integrity in the debt and equity market for the circular economy.

As our research is inclined towards circular economy projects, in the literature we mentioned that there are four components in the Green bond Principle that leads to a concrete framework but we can conclude that there is no specific universal framework or direction mentioned which can ease the work of issuers or investor to identify whether their project come under the circular economy category or not, thus lacks the uniformity under project selection and investment goals towards a circular economy and our research tries to address that issue.
As per the guideline they have defined a list of projects which should not be considered under the circular economy category:

- Waste projects that use landfill techniques; Projects that monetize by-products of fossil fuels and create further lock-in for fossil fuel usage as they are part of the traditional linear value chains.
- Not to classify renewable energy projects like solar, wind, and hydro energy - as circular economy projects. However, the production/use of renewable energy is a vital ingredient of a circular economy.
- Biomass and bio-waste to energy projects can be classified as circular economy projects under certain conditions:
- if they are part of larger circular value chains that aim to close material loops i.e., the feedstock is separately collected at source and by-products are used as fertilizers; where the biomass originates from sustainable sources and/or is a non-recyclable and non-hazardous waste.
- Resource efficiency measures are only considered circular where these incorporate the closure of material and resource loops. Resource efficiency measures that are linear in nature are excluded.

The above-listed not-to criteria can help issuers to direct their proceeds efficiently towards circular economy projects.

5.2 Limitations to Study

This study carried out a data-intensive exercise about the green-bond market with all the possible variables and tried to understand the pattern of investors who invest in circular economy-based projects. However, the methodology and results include some limitations. The main limitation of this study is the limitation to data availability as there might be more issuers who invest in circular economy projects but aren't considered in the research since the observation wasn't recorded in CBI data.

Another limitation to this study is the scale of the work. This study analyzed green bond data from 2015-2020, however, an important variable to consider is yielded to maturity and coupon rate which wasn't part of CBI, data analysis due to data limitation. Those variables could have helped to explore the green bond market more accurately. In this research, it was attempted to present the results as disaggregated as possible. However, the data was only allowed to go as far as it was shown. Also, an integrative literature review may not identify all

relevant literature on just green bonds finance towards circular economy projects and may not address the interplay among them to its full extent.

Chapter 6: Conclusion

Why research green bonds? Usually, bond investors do not have a lot of resources to know the performance on social and environmental criteria. Green bonds address this challenge in two ways. First, the structure of governance is simple. With a green bond, social responsibility is built into the terms of the financial instrument itself as the proceeds of green bonds are exclusively invested in green projects which gives an assurance to the investors. Second, the only downside is that a given green bond is capped. Also, Gren Bond ranks *pari passu* to any other plain vanilla bonds—that is, investors have direct recourse to the issuer if the issuer is unable to make interest payments or repay the principal on the bond (Park,2018).

We surely see a pattern in the growth of green bonds over time, but it is still a small instrument in the fixed income market. In this research, we analyzed the current green bond market, tried to see the pattern in the issuance of green bonds sector and by various regions, highlighted top issuers of the green bonds, and tried to understand circular economy projects which are financed using green bonds. Many research reports suggest that to scale the circular economy financing formalizing the circular economy, with the help of financial tools and framework, creating circular bond frameworks, introducing circularity measurements is crucial to direct more investments towards a circular economy.

The shifted focus from a linear economy to a circular economy will lead to higher resource efficiency, less resource use and value. This research suggests two pillars of recommendations to expand the green bond market focused on circular economy. First, we recommend if we want adequate financial data related to the circular economy and green bond it is vital to standardize the issuance through the development of a common green bond framework, which will attract a larger number of issuers and investors. Second, we recommend improving transparency and disclosure, by supporting knowledge sharing and requesting external review procedures for all issuers for better comparison.

The descriptive statistics of our research show that most green bonds fund wastewater and waste management projects under a circular economy. However, as the scale of the research expands, collecting the required data gets more challenging due to no well-defined category. Another potential approach as a follow-up to this work is to scale down and focus on

a detailed analysis of circular economy financed by both equity and debt markets (i.e., private equity, venture capital, public equity funds, investment, and commercial banking). This will help produce more disaggregated results to implement investment strategies more accurately. An implication of our findings is that the green third-party verifications are essential to reduce informational asymmetries and produce relatively more convenient financing conditions.

For the transition towards a circular and low carbon economy, the private sector has a key role to play. Private actors can accelerate this transition by incorporating sustainability throughout their operations based on life cycle approaches and cooperation with partners along the value chain. Offering products as a service and developing multi-sided platforms with at least two customer segments to reduce the length of value chains can be key features of such circular business models. By working closely together with stakeholders along the value chain businesses can make more efficient use of resources, reduce GHG emissions while also enhancing the resilience of their value chain (Alexandra and Charles,2020).

It is hoped that the results of this study can effectively demonstrate the need to change investment patterns towards circular economy projects and the necessity to move towards sustainable investment strategies.

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Appendix 1: Data Sorting and Analysis

I. Climate Bond Initiative Data

The data povided by CBI has 8111 instances with Dataframe of size (8111,8) after removing null values form the datframe the actual Data used for this thesis has a Dataframe size (8070,8) .All the attribtes are categorical except the amount issued and Issue date(Index).All the figure and aprroximate values mentioned in this thesis is based on Dataframe size(8070,8).There are 9 attributes considered for data visualization of the market :

SimplifiedIssuerName	The institutes name
Amount Issued	The amount issued in local currency
Currency	Name of the currency (EUR, CNY, USD,)
AmountIssuedUSD	Total amount issued in local currency converted to USD
Country Name	Issued country name
Issuer Type	Local Government, Financial Corporate, ABS (Asset Backened Securities, Non-Financial Corporate, Sovereign, Development Bank
Bond Region	Europe, Asia-Pacific, Africa, Supranational, N America.
UoPSummary	Energy, Buildings, Land use, Transport, Water
Issue Date	The issue date of green bond (2015-2021)
Maturity Date	The tenor duration

```
In [6]: xxx.describe()
Out[6]:
          IssueDate       Tenure  AmountIssuedUSD
count   8070.000000  7927.000000      8070.000000
mean    2018.532838    10.712754       124.485966
std        1.498411     6.622618       242.223922
min     2015.000000     0.000000         0.015000
25%     2017.000000     7.000000        12.249700
50%     2019.000000    10.000000        28.977250
75%     2020.000000    12.000000        94.261250
max     2021.000000   100.000000      2110.748432

In [7]:
```

Year	Total no of observation
2015	252
2016	392
2017	1565
2018	1603
2019	1862
2020	1734

The table shows the no of observations or the data points in our data frame for the respective year. All the analysis in the thesis is based on these observations. The count, mean, max, min rows are self-explanatory. The null values are ignored. The std row shows the standard deviation (which measures how dispersed the values are). The 25%,50% and 75% row show the corresponding percentiles: a percentile indicates the value below which a given percentage of observations in a group of observations falls. For e.g., 25% of Issuers have AmountIssuedUSD lower than 12.3M, while 50% are lower than 29M and 75% are lower than 94M.

The tables provided below consists of top issuers in various regions

1.Top green Bond Issuers in Europe from 2015-2021

SimplifiedIssuerName	AmountIssuedUSD (Millions)	Country Name	Issuer Type	Bond Region	UoPSummary	Issue Date	Maturity Date
Société du Grand Paris	2006.375	France	Government-Backed Entity	Europe	Transport,	2018	2028
KfW	2000	Germany	Development Bank	Europe	Energy, Buildings,	2019	2029
KfW	2000	Germany	Development Bank	Europe	Energy, Buildings,	2020	2030
Republic of France	1958.6412	France	Sovereign	Europe	Energy, Buildings, Transport, Waste, Land Use, Unalloc. A&R,	2019	2039
EDF	1934.8	France	Government-Backed Entity	Europe	Energy,	2016	2026
Republic of France	1922.0064	France	Sovereign	Europe	Energy, Buildings, Transport, Waste, Land Use, Unalloc. A&R,	2017	2039
Republic of France	1847.43804	France	Sovereign	Europe	Energy, Buildings, Transport, Waste, Land Use, Unalloc. A&R,	2019	2039
DNB ASA	1818.21	Norway	Financial Corporate	Europe	Buildings,	2021	2031
Republic of France	1802.5475	France	Sovereign	Europe	Energy, Buildings, Transport, Waste, Land Use, Unalloc. A&R,	2021	2039
Landwirtschaftliche Rentenbank	1761	Germany	Development Bank	Europe	Energy,	2020	2027

2.Top Green Bond Issuers in N America 2015-2021

SimplifiedIssuerName	AmountIssuedUSD (Millions)	Country Name	Issuer Type	Bond Region	UoPSummary	Issue Date	Maturity Date
New York MTA	2021.462	United States	Local Government	N America	Transport,	2017	2040
New York MTA	1725	United States	Local Government	N America	Transport,	2020	2049
Toyota	1600	United States	ABS	N America	Transport,	2016	2022
Digital Realty Trust	1555.12	United States	Financial Corporate	N America	Buildings,	2020	2030
Apple INC	1500	United States	Non-Financial Corporate	N America	Energy, Buildings, Water, Waste,	2016	2023
Citigroup	1500	United States	Financial Corporate	N America	Energy, Buildings, Transport, Water,	2020	2024
Los Angeles County MTA	1356.095	United States	Local Government	N America	Transport,	2020	2037
Equinix	1307.012	United States	Non-Financial Corporate	N America	Energy, Buildings, Transport, Water, Waste,	2021	2033
Toyota	1250	United States	ABS	N America	Transport,	2015	2021
Southern Power Company	1244.1	United States	Non-Financial Corporate	N America	Energy,	2016	2026

3.Top Green Bond Issuers in Africa 2015-2021

SimplifiedIssuerName	AmountIssuedUSD (Million)	Country Name	Issuer Type	Bond Region	UoPSummary	Issue Date	Maturity Date
Arab Republic of Egypt	750	Egypt	Sovereign	Africa	Energy, Buildings, Transport, Water, Waste, Land Use, Industry, ICT,	2020	2025
Redstone Solar Plant	566.56	South Africa	Other Debt Instrument	Africa	Energy,	2019	2036
FirstRand Bank	225	South Africa	Other Debt Instrument	Africa	Water,	2020	
Standard Bank of South Africa	200	South Africa	Financial Corporate	Africa	Energy, Buildings, Water,	2020	2030
Banque Centrale Populaire	150.876	Morocco	Financial Corporate	Africa	Energy,	2017	2027
MASEN	117.07	Morocco	Government-Backed Entity	Africa	Energy,	2016	2034
Nedbank	115.9765	South Africa	Financial Corporate	Africa	Energy,	2019	2026
Growthpoint Properties	93.1073	South Africa	Financial Corporate	Africa	Buildings,	2018	2028
City of Cape Town	77.229	South Africa	Local Government	Africa	Transport, Water,	2017	2027
Nedbank	68.24	South Africa	Financial Corporate	Africa	Energy,	2019	2024

4.Top 10 Issuers in Supranational from 2015-2021

SimplifiedIssuerName	AmountIssuedUSD (Millions)	Country Name	Issuer Type	Bond Region	UoPSummary	Issue Date	Maturity Date
EIB	1500	Supranational	Development Bank	Supranational	Energy, Buildings,	2016	2026
EIB	1500	Supranational	Development Bank	Supranational	Energy, Buildings,	2017	2027
EIB	1500	Supranational	Development Bank	Supranational	Energy, Buildings,	2018	2025
EIB	1500	Supranational	Development Bank	Supranational	Energy, Buildings,	2020	2030
ADB	1250	Supranational	Development Bank	Supranational	Energy, Buildings, Transport, Water,	2017	2027
EIB	1135.2	Supranational	Development Bank	Supranational	Energy, Buildings,	2017	2047
EIB	1128.4	Supranational	Development Bank	Supranational	Energy, Buildings,	2020	2035
IFC	1000	Supranational	Development Bank	Supranational	Energy, Buildings, Transport, Land Use,	2017	2022
EIB	1000	Supranational	Development Bank	Supranational	Energy, Buildings,	2019	2029
ADB	982.48	Supranational	Development Bank	Supranational	Energy, Buildings, Transport, Water,	2021	2026

5.Top 10 Issuers in Asia-Pacific 2015-2021

SimplifiedIssuerName	AmountIssuedUSD (Millions)	Country Name	Issuer Type	Bond Region	UoPSummary	Issue Date	Maturity Date
Beijing Jingneng Clean Energy	2110.748	China	Local Government	Asia-Pacific	Energy,	2020	
ICBC	1500	China	Financial Corporate	Asia-Pacific	Energy, Transport, Water,	2019	2024
Bank of Jiangsu	1491.39	China	Financial Corporate	Asia-Pacific	Energy, Buildings, Transport, Water, Waste, Unalloc. A&R,	2019	2022
China Development Bank	1422.032	China	Development Bank	Asia-Pacific	Energy, Transport, Water, Waste, Land Use, Industry,	2019	2022
M+S	1414.159	Singapore	Other Debt Instrument	Asia-Pacific	Buildings,	2020	
Huaxia Bank	1413.676	China	Financial Corporate	Asia-Pacific	Energy, Transport, Water, Waste,	2020	2023
Adani Green Energy	1350	India	Other Debt Instrument	Asia-Pacific	Energy,	2021	
Treasury Corp New South Wales	1313.46	Australia	Local Government	Asia-Pacific	Buildings, Water,	2018	2028
ICBC	1291.95	China	Financial Corporate	Asia-Pacific	Energy, Transport,	2017	2020
Republic of Indonesia	1250	Indonesia	Sovereign	Asia-Pacific	Energy, Buildings, Transport, Waste, Land Use, Unalloc. A&R,	2018	2023

Appendix 2: Circular Economy Project Description as per Second Party opinion review

Simplified Issuer name	Projects description as Per Second-Party-Opinion reviews	Second-party Opinion
Acea WASTEWATER MANAGEMENT AND WATER/ ENERGY EFFICIENCY	The eligible project categories include "circular economy projects" such as wastewater management, anaerobic digestion of biowaste and/or sewage sludge, waste management, water supply, smart meters, electric vehicles, charging station for electric vehicles, energy efficiency improvement in transmission and distribution networks, and solar PV.	ISS-ESG
AUGA Group FOOD AND AGRICULTURE	Closed-loop organic farming: Synergies among different parts of agricultural operations are harnessed with an end-goal of a fully functioning circular economy model.	CICERO
City of Toronto NO SPECIFIC SECTOR	eco-efficient and/or circular economy principles integration, including but not limited to: use of recycled or alternative building materials in development and redevelopment, establishment of alternatives to traditional product consumption models towards rental, maintenance, repair services for infrastructure designs and upgrades, adapted products, production technologies and processes which minimize negative externalities and maximize resource value to its greatest potential	Sustainalytics
Coca Cola FEMSA PLASTICS AND PACAGED GOODS	Under its Eco-efficient and/or circular economy products, production technologies and processes category, Coca-Cola FEMSA will invest in the procurement of recycled PET resin (rPET) for its PET packaging.	Sustainalytics
Daimler AG POLLUTION PREVENTION AND CONTROL	This category includes investments in pollution prevention and control that can be related to fossil fuel equipment in Daimler's production processes for conventional vehicle production. No quantified thresholds are defined to qualify under the framework. 1. Examples include paint process improvement (VOC emissions reductions, exhaust air treatments), plastic waste reduction measures and other circular economy concepts.	CICERO
Electrolux WASTE MANAGEMENT	It is a strength that the proceeds of Electrolux's Green Bond Framework will be used to divert any waste from landfills. Through Electrolux's focus on recycling processes, Electrolux contributes to the development of the circular economy. Efficient utilization of resources is a vital component of the transition to low-carbon and climate resilient growth. Life-Cycle-Analyses (LCA) is conducted to analyse the environmental impact of transporting recycled materials (such as plastics) to point of usage.	CICERO
Hafslund E-Co WASTEWATER MANAGEMENT AND WATER	At least 70 % (by weight) of the non-hazardous construction and demolition waste (excluding naturally occurring material24) generated on the construction site is prepared for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials.	CICERO
Ijsbeer Energie Europa BV WASTEWATER MANAGEMENT AND WATER	Project Ice Block, which is a collaboration between IJsbeer and Kvitebjørn Energy AS /Daimyo, a Norwegian industrial investment company that invests in sustainable industry and real estate including in renewable energy, recycling, and aquaculture. The project will retrofit the CHP plant to increase usage of surplus heat from the CHP plant from 25% to ~90%, using circular economy as a guiding principle. Proceeds are planned for modifications and adaptation of the existing CHP facility (which runs entirely on locally sourced biomass) to align and connect with the pallet block and hot water production (heat take-off unit). Investments include, but are not limited to, belt dryers, extrusion presses, and robotic packaging and storage systems	CICERO

Mowi ASA **SUSTAINABLE AQUACULTURE/PACKAGING GOODS AND PLASTICS**	Environmentally sustainable aquaculture; Energy efficiency; Water and wastewater management; Waste management; Eco-efficient and/or circular economy adapted products, production technologies and processes. Currently, Mowi anticipates allocating 60% of the use of proceeds to Sustainable Aquaculture and the remainder mostly to Water and Wastewater management. Zero to 20% of the proceeds will go to refinancing. Investments in resource efficient products and solutions, such as new net and packaging designs focused on reducing, recycling and replacing plastic raw material. This can include lightweight packaging materials, developing mono-material solutions that are easier to recycle, finding compostable packaging alternatives and replacing plastic packaging by cardboard alternatives.	CICERO
Neste Oyj WASTEWATER MANAGEMENT AND WATER	Neste's target related to circular economy solutions is to use entirely waste and residue materials for renewable products by 2025, from the current 80%. This includes a gradual reduction in the use of palm oil in the production of renewable diesel from ca 20% in 2020, and to replace virgin vegetable oils with waste and residues. Neste is also focusing on chemical recycling, aiming to utilise waste with no or low value in mechanical recycling. For their chemical recycling, Neste is targeting consumer waste that is not suitable for mechanical recycling. The sorting of waste takes place at the latest at the liquefaction facilities.	CICERO
NIB WASTE MANAGEMENT	Projects in resource efficiency aimed at maintaining the value of products, materials, and resources in the economy for as long as possible in support to a transition to a circular economy model (closing material loops; substitution of virgin raw materials; and reduced waste and pollution). 1. Infrastructure for better waste management supporting pollution prevention (such as emissions of air pollutants and discharges to water) 2. Energy recovery from waste: 3. Production of biogas from organic waste 4.Waste-to-energy plants, considering the targets of the Circular Economy Policy and minimizing the combustion of recyclable materials.	CICERO
Rabobank **REAL ESTATE**	Green Real Estate: Rabobank has the ambition to move its entire real estate portfolio towards energy label A. By 2030, the bank aims for its real estate portfolio to have obtained energy label C or higher. Through this, Rabobank contributes to climate mitigation by limiting greenhouse gas emissions through e.g., Increased use of renewable energy in the built environment, energy efficiency in buildings and an advocating for the important shift towards a circular economy.	ISS-ESG
Rabobank WASTE MANAGEMENT	Waste management and circular economy Green and Sustainable Assets may include financing projects contributing to the development of a circular economy such as: ▪ Recycling facilities, waste-to-energy facilities, reuse maximization ▪ Environmental remediation ▪ Projects to salvage, use, reuse and recycle post-consumer waste products ▪ Environmental remediation projects	ISS-ESG

Renewi WASTE MANAGEMENT	The company established the Circular Coalition in 2016, a partnership of Renewi customers who support the transition to a circular economy. Through this collaboration the stakeholders create new approachesand business models to reduce waste. In Sustainalytics view, those practices demonstrate the company's willingness to promote sustainability beyond its own operations. Sustainalytics is of the opinion that green bonds and loans issued by Renewi under its Green FinanceFramework will contribute to its aim to promote a sustainable society in general and circular economy through extracting value from waste. Overall, Sustainalytics is confident that Renewi is well positioned to issue green bonds and finance, or refinance related green loans.	Sustainalytics
Reykjavik Energy WASTEWATER MANAGEMENT AND WATER	Circular economy activities that lead to lower lifecycle energy and GHG usage Industrial symbiosis: to develop opportunities for industrial symbiosis by utilizing waste streams from geothermal production, such as geothermal gases and warm geothermal effluent, to create value from waste	CICERO
SID Banka WASTE MANAGEMENT/ WASTEWATER MANAGEMENT AND WATER	SID Bank includes circular economy in its financial programmes for SMEs by promoting, e.g. the purchase of secondary raw materials or waste, the development and production of new products from secondary raw materials and the development and production of reusable waste for the same product, demonstrating the bank's efforts to foster environmental protection.	Sustainalytics
Société Generale WASTE MANAGEMENT	i. Circular products: design, production or use-related projects meeting one of the following criteria: • reduce waste and improve materials recycling at the beginning of a product's lifecycle (e.g. design for modularity, easy disassembly and improved recyclability) • substitute virgin raw materials with secondary (recycled) materials originating from materials and resources recovery • increase the value and use of a product during an extended life (e.g. through reuse/refurbishment/repair/remanufacture) ii. Circular process: projects that significantly improve effectiveness and efficiency of resources consumption, within a company's operations or along its supply chain iii. Circular Value recovery: projects that aim to maximise recovery and recycling of a product after its end-of-life stage (e.g. material recovery from separately collected waste producing secondary raw materials	ISS-ESG
Sparebank 1 SMN NO SPECIFIC SECTOR	Regarding Eco-efficient and/or circular economy adapted products, production technologies and processes, SMN may provide general purpose financing to corporations and/or SME's that derive >90% of their revenues from the sale of certified products, services, or processes.	Sustainalytics

Stockholm's Lans Landsting WASTE MANAGEMENT	According to the issuer, projects in this category will focus on recycling programsfor non-organic materials like plastics and metals. This includes technology andequipment such as optic sorting systems for separating waste streams, sensors, scalesand counting equipment, and interfaces to connect scales and other measuring equipment with computers. • According to the issuer, waste from the County's facilities – mainly food and biological waste from hospitals – could be used as feedstocks for biogas generation in waste-to-energy and circular economy programs. • The issuer has indicated that this category does not include financing for wastecollection fleets or construction of facilities. The issuer intends to use proceeds to invest in the development a circular economy by reducing waste generation and managing remaining waste more effectively.	CICERO
Swedavia WASTE MANAGEMENT/ WASTEWATER MANAGEMENT AND WATER	Pollution prevention and control: Investments in waste recycling, waste minimization and energy/emission efficient waste management. Waste and wastewater recycling is key for a climate resilient future and a circular economy This category includes treatment facilities of wastewater that contains Mon propylene glycol, which is used for de-icing of airplanes Swedavia has a zero-landfill policy	CICERO
Uniqa Insurance Group WASTE MANAGEMENT/ WASTEWATER MANAGEMENT AND WATER	As part of the Pollution Prevention and Control category, UNIQA intends to finance Municipal Waste to Energy projects, which includes mechanical-biological treatment, materials recovery, combustion with energy recovery, and anaerobic digestion. Sustainalytics views positively the inclusion of acceptable levels of thermal efficiency 5 as part of the eligibility criteria, and highlights that intended projects promote the removal of recyclables prior to incineration, which Sustainalytics considers to be in line with the objective of moving toward a circular economy.	Sustainalytics
UPM-Kymmene Oyj CHEMICAL WASTE MANGEMENT	Climate positive products and solutions Proceeds will be used to finance the development, operations, maintenance and expansion of the production of climate positive products and solutions Eligible projects include, but are not limited to: • Development of Beyond fossils R&D investments to develop next generation biochemicals and biofuels • Investments in bio-refinery facilities Our biorefinery will produce a range of 100% wood-based biochemicals which enable a switch from fossil raw materials to sustainable alternatives in various consumer-driven end-uses	CICERO
Alphabet (Sustainability Bond) PACKAGING GOODS AND PLASTICS/ WASTE MANAGEMENT	Expenditures related to projects that increase waste diversion from landfill and design out waste. Example projects may include, but are not limited to: • Increasing use of sustainable, recycled, or reused materials, such as post-consumer recycled (PCR) plastic in consumer hardware devices • Creating new sources of or increasing supply of more sustainable materials • Improving recovery of materials • Reducing waste generation from the construction and operation of offices and cafes	Sustainalytics

Philips (Green and Sustainability innovation bond) WASTE MANAGEMENT	Philips expenditures regarding the implementation of circular products and solutions are aligned with the GBP category of eco-efficient and/or circular economy adapted products, production technologies and processes. Proceeds will finance the book value of assets that Philips has refurbished, reconditioned, or remanufactured, and the costs involved in refurbishing, reconditioning, or remanufacturing, facilitating a second life for devices and components that are no longer in use. Proceeds will also finance the procurement of recycled plastics.	Sustainalytics
Intesa Sanpaolo WASTE MANAGEMENT/FINANCING INOVATIONS	The Circular Economy Eligible Categories aim to finance companies whose projects are defined as circular according to the below mentioned 5 criteria and the related sub-criteria, through the € 5 Bln Circular Economy Plafond launched in 2018.The contemplated bond issuance's proceeds will be fully allocated to finance/refinance credits granted through the Circular Economy (CE) Plafond launched by Intesa Sanpaolo in September 2018. CE Plafond is a credit facility aimed to support the transition towards a more Circular Economy. The CE Plafond, consisting of € 5 billion within the 2018-2021 Business Plan, is dedicated to the most innovative companies or projects in the Circular Economy field. Access to CE Plafond is regulated by both ordinary credit procedures and compliance with a set of eligibility criteria. Such criteria of "circularity" were developed in partnership by Intesa Sanpaolo Innovation Centre and the Ellen MacArthur Foundation. Excluded Categories and limitations Circular Economy - Use of toxic materials and waste to energy practices from unsorted waste (not organic products) areexcluded from the Circular Economy perimeter, since they are harmful to humans & environment and leads to loss of value & materials. Use of ce proceeds -1 - Solutions that extend the product-life or cycles of use of goods and/or materials 2 – Production processes fuelled by and/or products made of renewable or recycled resources 3 - Products and/or services that significantly increase effectiveness and efficiency of the resources consumption, within the company or along its supply chain 4 - Design and/ormanufacture products that can be fully recycled or composted within an efficient framework of collection, separation and recycling after use 5 – Innovative technologies to enable circular business models	ISS-ESG

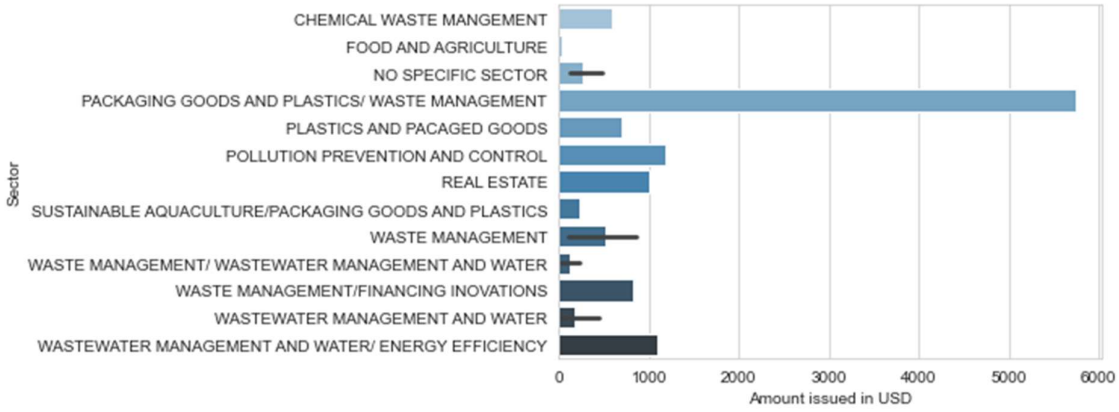
Table 3: Project Descriptions as per Second Party Opinion drafts

The table aims to provide a rough indication of what kind of projects or production activity issuers think is inclined towards their circular economy goals. Indeed, more in-depth analysis by sector would be required to draw a concrete pattern related to investments or any other financial decision focused on circular economy.

	Amount issued in USD (millions)	coupon rate (%)
count	27	23
mean	659	1.82
standard deviation	1101.66	2.18
min	21.6	0
25%	93.49	0.61
50%	230.79	0.88
75%	915.42	2.6
max	5750	9.5

Table 2: Summary Statistics of companies partially investing in CE projects

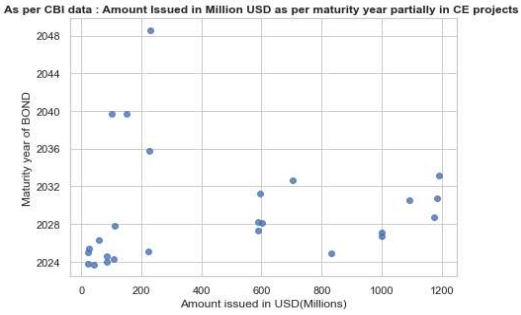
The count represents the no of datapoints in the dataset. The mean under Amount issued in USD (million) is the total mean of the 27 issuers amount. There is no clear percentage of total issued amount of bond directed towards circular economy projects mentioned in the second party opinion review or in the annual report. We assume that a significant percent is/will be invested for the projects described under circular economy until the maturity date of the bond.

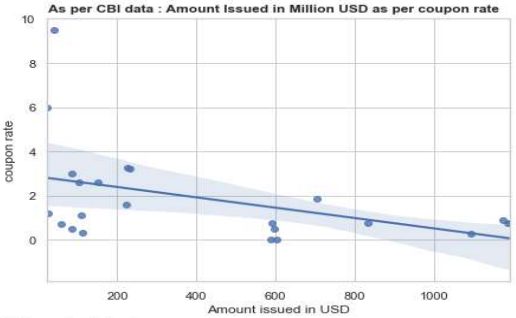


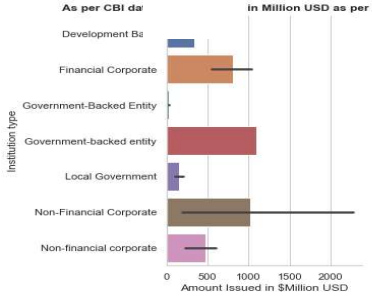
The bar plot represents the distribution of Amount of issuance in (USD$M) as per various sector mentioned in the table above. While going through the second party opinion the issuer mentioned combination of sectors where the proceeds will be directed, the bar plot helps to visualize the issuance amt of green bonds as per sector. The sectors selected above are based on the description of project category/sector mentioned in the second party opinion reviews of the issuer.

Appendix 3: **: Observations of companies directing part of their proceeds towards circular economy projects via green bond issuance**

Simplified Issuer name	Amount Issued	Currency	Amount issued in USD	Issue Date	Maturity Date	Country	Institution type	Region	Use of Proceeds	coupon rate
Acea	900000000	EUR	1091389000	28-01-2021	28-07-2030	Italy	Government-backed entity	Europe	Energy, Transport, Water, Waste,	0.25%
AUGA Group	20000000	EUR	22324000	17-12-2019	17-12-2024	Lithuania	Non-Financial Corporate	Europe	Energy, Land Use,	6%
City of Toronto	200000000	cad	150656000	24-09-2019	24-09-2039	Canada	Local Government	N America	Energy, Buildings, Transport, Water, Waste, Unalloc. A&R,	2.60%
City of Toronto	300000000	cad	230790000	01-08-2018	01-08-2048	Canada	Local Government	N America	Transport,	3.20%
City of Toronto	130000000	CAD	101895055	16-12-2020	24-09-2039	Canada	Local Government	N America	Energy, Buildings, Transport, Water, Waste, Unalloc. A&R,	2.60%
Coca Cola FEMSA	705000000	USD	705000000	01-09-2020	01-09-2032	Mexico	Non-Financial Corporate	LAC	Energy, Buildings, Waste, Land Use,	1.85%
Daimler AG	1000000000	EUR	1184900000	10-09-2020	10-09-2030	Germany	Non-Financial Corporate	Europe	Energy, Transport, Waste, Industry,	0.75%
Daimler AG	1000000000	EUR	1189790000	11-03-2021	11-03-2033	Germany	Non-Financial Corporate	Europe	Energy, Transport, Waste, Industry,	0.75%
Electrolux	1000000000	SEK	107800581.3	27-03-2019	27-03-2024	Sweden	Non-Financial Corporate	Europe	Energy, Buildings, Waste, Industry,	1.10%
Hafslund E-Co	500000000	NOK	58337800	30-03-2021	30-03-2026	Norway	Non-Financial Corporate	Europe	Energy, Transport,	0.72%
Ijsbeer Energie Europa BV	35000000	EUR	41384000	07-09-2020	07-09-2023	Netherlands	Non-Financial Corporate	Europe	Energy,	9.50%
Mowi ASA	200000000	EUR	222300000	31-01-2020	31-01-2025	Norway	Non-financial corporate	Europe	Water, Waste, Land Use,	1.60%
Neste Oyj	500000000	EUR	590100000	25-03-2021	25-03-2028	Finland	Non-financial corporate	Europe	Transport,	0.75%
NIB	500000000	EUR	587300000	01-04-2021	30-04-2027	Supranationals	Development Bank	Supranational	Energy, Buildings, Transport, Water, Waste,	0%
Robobank	1000000000	USD	1000000000	24-09-2020	24-09-2026	Netherlands	Financial Corporate	Europe	Energy	
Rabobank	1000000000	USD	1000000000	24-02-2021	24-02-2027	Netherlands	Financial Corporate	Europe	Energy,	
Renewi	75000000	EUR	85095000	19-07-2019	19-07-2024	UK	Non-Financial Corporate	Europe	Waste,	3%
Reykjavik Energy	3000000000	ISK	21603658.54	20-10-2020	23-10-2023	Iceland	Government-Backed Entity	Europe	Energy,	
SID Banka	75000000	EUR	85080000	05-12-2018	12-12-2023	Slovenia	Development Bank	Europe	Energy, Buildings, Transport, Water, Waste, Land Use, Industry,	0.50%
Societe Generale	1000000000	EUR	1174000000	22-09-2020	22-09-2028	France	Financial Corporate	Europe	Energy,	0.88%
Sparebank 1 SMN	500000000	EUR	603079000	18-02-2021	18-02-2028	Norway	Financial Corporate	Europe	Energy,	0.01%
Stockholms Lans Landsting	1000000000	SEK	112443908.3	02-11-2020	02-11-2027	Sweden	Local Government	Europe	Buildings, Transport, Water, Waste,	0.29%
Swedavia	250000000	SEK	25991587.96	26-05-2020	26-05-2025	Sweden	Government-Backed Entity	Europe	Energy, Buildings, Transport, Water,	1.21%
Uniqa Insurance Group	200000000	EUR	226840000	09-07-2020	09-10-2035	Austria	Financial Corporate	Europe	Energy, Transport, Water, Waste,	3.25%
UPM-Kymmene Oyj	500000000	EUR	596300000	22-03-2021	22-03-2031	Sweden	Non-financial corporate	Europe	Energy, Water, Waste, Land Use,	0.50%
Alphabet(Sustainability Bond)			5750000000	31-07-2020		USA	Non-Financial Corporate	N America	Energy Effeciency,clean energy ,green buildings,circular economy and design,affordable housing,racial equity,COVID-19 small buisness support.	
Intesa Sanpaolo	750000000	EUR	830857500	04-12-2019	04-12-2024	Italy	Financial Corporate	Europe	Energy, Transport, Water, Waste, Land Use, Industry, ICT,	0.75%







Simplified Issuer name	Amount Issued	Currency	Amount issued in USD	Issue Date	Maturity Date	Country	Second-party Opinion	Link to second-party opinion	Institution type	Region	Use of Proceeds	coupon rate	Link to information
Acea	900000000	EUR	1091389000	28-01-2021	28-07-2030	Italy	ISS-ESG	https://www.gruppo.acea.it/content/dam/acea-corporate/acea-foundation/pdf/en/company/investors/2021/green-bond/second-party-opinion.pdf	Government-backed entity	Europe	Energy, Transport, Water, Waste,	The Bonds were issued under the Base Prospectus updated on 24 July 2020 and subsequently supplemented on 15 January 2021. The first tranche of €300m and a coupon of 0% will mature on 28 September 2025 (the "Bonds 2025"), whilst the second tranche of €600m and a coupon of 0.25% will mature on 28 July 2030 (the "Bonds 2030").	https://www.gruppo.acea.it/content/dam/acea-corporate/acea-foundation/pdf/en/company/media/comunicati-ps/2021/01/AceaCPS-21012021-01-en.pdf
AUGA Group	20000000	EUR	22324000	17-12-2019	17-12-2024	Lithuania	CICERO	https://cicero.oslo.no/file/1238/Auga_CICERO_SoG_27Nov2019.pdf	Non-Financial Corporate	Europe	Energy, Land Use,	The final term sheet of the first tranche of bonds indicates that the offering of up to EUR 20 million will be issued, and the nominal value of one bond will be EUR 1000. Maturity date is 11 December 2024, annual interest – 6 per cent. The bonds have 100% collateral coverage by the land owned and cultivated by the group companies in Lithuania.	https://auga.lt/en/the-first-tranche-of-auga-group-green-bonds-programme-will-be-offered-next-week/
City of Toronto	200000000	cad	150656000	24-09-2019	24-09-2039	Canada	Sustainalytic	https://www.toronto.ca/wp-content/uploads/2018/03/8fb2-City-TO-Green-Debenture-Framework_SPO_FINAL-03192018.pdf	Local Government	N America	Energy, Build	2.60%	https://www.toronto.ca/news/city-of-toronto-reopens-green-bond-to-help-fund-projects-that-mitigate-the-effects-of-climate-change/
City of Toronto	300000000	cad	230790000	01-08-2018	01-08-2048	Canada	Sustainalytic	https://www.sustainalytics.com/wp-content/uploads/2018/04/City-TO-Green-Debenture-Framework_SPO_FINAL-03192018.pdf	Local Government	N America	Transport,	3.20%	https://www.toronto.ca/city-government/budget-finances/city-finance/investor-relations/recently-settled-bond-issues/
City of Toronto	130000000	CAD	101895055	16-12-2020	24-09-2039	Canada	Sustainalytic	https://www.toronto.ca/wp-content/uploads/2018/03/8fb2-City-TO-Green-Debenture-Framework_SPO_FINAL-03192018.pdf	Local Government	N America	sport, Water,	2.60%	https://www.toronto.ca/city-government/budget-finances/city-finance/investor-
Coca Cola FEMSA	705000000	USD	705000000	01-09-2020	01-09-2032	Mexico	Sustainalytic	https://coca-colafemsa.com/wp-content/uploads/2020/08/5.-KOF-GB-Sustainalytics-SPO.pdf	Non-Financial Corporate	LAC	Energy, Buildings, Waste, Land	1.85%	https://coca-colafemsa.com/en/coca-cola-femsa-prices-us-705-million-
Daimler AG	1000000000	EUR	1184900000	10-09-2020	10-09-2030	Germany	CICERO	https://www.daimler.com/dokumente/investoren/anleihen/rating/2020-06-18-daimler-green-finance-2nd-opinion-cicero.pdf	Non-Financial Corporate	Europe	nsport, Wast	0.75%	https://www.daimler.com/investors/refinancing/green-finance/
Daimler AG	1000000000	EUR	1189790000	11-03-2021	11-03-2033	Germany	CICERO	https://www.daimler.com/dokumente/investoren/anleihen/rating/2020-06-18-daimler-green-finance-2nd-opinion-cicero.pdf	Non-Financial Corporate	Europe	Energy, Transport, Waste, Industry,	0.75%	https://www.daimler.com/investors/refinancing/green-finance/
Electrolux	1000000000	SEK	107800581.3	27-03-2019	27-03-2024	Sweden	CICERO	https://www.electroluxgroup.com/en/wp-content/uploads/sites/2/2019/03/second-opinion-from-cicero-2019.pdf	Non-Financial Corporate	Europe	Energy, Buildings, Waste, Industry,	1.10%	https://www.electroluxgroup.com/en/electrolux-issues-sek-1-billion-green-bond-29417/
Hafslund E-Co	500000000	NOK	58337800	30-03-2021	30-03-2026	Norway	CICERO	https://s3.eu-north-1.amazonaws.com/hafslundeco/images/20210310-Hafslund-Eco_Second-Party-Opinion.pdf?mtime=20210316142738&focal=none	Non-Financial Corporate	Europe	Energy, Transport,	0.72%	
Ijsbeer Energie Europa BV	35000000	EUR	41384000	07-09-2020	07-09-2023	Netherlands	CICERO	https://bit.ly/2R5PdFu	Non-Financial Corporate	Europe	Energy,	9.50%	
Mowi ASA	200000000	EUR	222300000	31-01-2020	31-01-2025	Norway	CICERO	https://corpsite.azureedge.net/corpsite/wp-content/uploads/2020/01/CICERO_SoG_Mowi_SPO_20Jan2020.pdf	Non-financial corporate	Europe	Water, Waste, Land Use,	EURIBOR + 1.60% payable quarterly in arrears on or about 31 January, 30 April, 31 July and 31 October	https://mowi.com/investors/share-and-bond/bonds/
Neste Oyj	500000000	EUR	590100000	25-03-2021	25-03-2028	Finland	CICERO	https://www.neste.com/sites/neste.com/files/attachments/second_party_opinion_-_cicero_shades_of_green.pdf	Non-financial corporate	Europe	Transport,	0.75%	https://www.neste.com/releases-and-news/neste-corporation-issues-eur-500-million-green-bond
NIB	500000000	EUR	587300000	01-04-2021	30-04-2027	Supranationals	CICERO	https://www.nib.int/filebank/a/1543994112/b73808a25e5690ce22263ec0af60c85d/9091-CICERO_NIB_Second_Opion_Dec_2018.pdf	Development Bank	Supranationals	Energy, Buildings, Transport, Water, Waste,	0%	zero coupon bond https://nordsip.com/2020/04/28/nib-issues-euro-green-bond/
Robobank	1000000000	USD	1000000000	24-09-2020	24-09-2026	Netherlands	ISS-ESG	https://www.rabobank.com/en/images/iss-esg-second-party-opinion-on-rabobank-sustainable-funding-framework-september-2020.pdf	Financial Corporate	Europe	Energy		
Rabobank	1000000000	USD	1000000000	24-02-2021	24-02-2027	Netherlands	ISS-ESG	https://www.rabobank.com/en/images/iss-esg-second-party-opinion-on-rabobank-sustainable-funding-framework-september-2020.pdf	Financial Corporate	Europe	Energy,		

Renewi	75000000	EUR	85095000	19-07-2019	19-07-2024	UK	Sustainalytic	https://www.sustainalytics.com/wp-content/uploads/2018/05/Renewi-Green-Finance-Framework-Second-Party-Opinion-Sustainalytics_final-v.2.pdf	Non-Financial Corporate	Europe	Waste,	3%	https://www.renewi.com/en/green-bond-2019
Reykjavik Energy	3000000000	ISK	21603658.54	20-10-2020	23-10-2023	Iceland	CICERO	https://www.or.is/sites/or.is/files/reykjavik_energy_or_-_second_opinion_-_cicero.pdf	Government-Backed Entity	Europe	Energy,		
SID Banka	75000000	EUR	85080000	05-12-2018	12-12-2023	Slovenia	Sustainalytic	https://www.sid.si/sites/www.sid.si/files/documents/investitorji/sid_green_bond_spo_final.pdf	Development Bank	Europe	Energy, Buildings, Transport, Water, Waste, Land Use, Industry,	0.50%	https://www.sid.si/en/news/sid-bank-issues-first-green-bond
Societe Generale	1000000000	EUR	1174000000	22-09-2020	22-09-2028	France	ISS-ESG	https://investors.societegenerale.com/sites/default/files/documents/2020-08/ISS_ESG_Second_Party_Opinion_2020.pdf	Financial Corporate	Europe	Energy,	0.88%	https://cbonds.com/bonds/807751/
Sparebank 1 SMN	500000000	EUR	603079000	18-02-2021	18-02-2028	Norway	Sustainalytic	https://www.bourse.lu/security/XS2240326921/312871	Financial Corporate	Europe	Energy,	0.01%	https://www.bourse.lu/security/XS2303089697/331581
Stockholms Lans Landsting	1000000000	SEK	112443908.3	02-11-2020	02-11-2027	Sweden	CICERO	https://www.sll.se/globalassets/6.-om-landstinget/ekonomi/finansiering/sll_green-bond-second-opinion.pdf	Local Government	Europe	Buildings, Transport, Water, Waste,	0.29%	https://cbonds.com/bonds/975635/
Swedavia	250000000	SEK	25991587.96	26-05-2020	26-05-2025	Sweden	CICERO	https://cicero.oslo.no/file/1238/swedavia_spo_cicero_Green_26092019.pdf	Government-Backed Entity	Europe	Energy, Buildings, Transport, Water,	1.21%	https://cbonds.com/bonds/741393/
Uniqa Insurance Group	200000000	EUR	226840000	09-07-2020	09-10-2035	Austria	Sustainalytic	https://www.uniqagroup.com/gruppe/versicherung/media/files/UNIQA_Green_Bond_Framework_Second_Party_Opinion_Final_0906.pdf	Financial Corporate	Europe	Energy, Transport, Water, Waste,	3.25%	https://cbonds.com/bonds/751149/
UPM-Kymmene Oyj	500000000	EUR	596300000	22-03-2021	22-03-2031	Sweden	CICERO	https://www.upm.com/siteassets/asset/investors/debt/cicero-spo_upm-green-finance-framework.pdf	Non-financial corporate	Europe	Energy, Water, Waste, Land Use,	0.50%	https://cbonds.com/bonds/955393/
Alphabet(Sustainability Bond)			5750000000	31-07-2020		USA	Sustainalytic	https://mstar-sustops-cdn-mainwebsite-s3.s3.amazonaws.com/docs/default-source/spos/alphabet-sustainability-bond-framework-second-party-opinion.pdf?sfvrsn=e3152f5e_3	Non-Financial Corporate	N America	Energy Effeciency,clean energy ,green buildings,circular economy and		
Intesa Sanpaolo	1250000000	EUR	1490750000	16-03-2021	16-03-2028	Italy	ISS-ESG	https://group.intesasanpaolo.com/content/dam/portalgroup/repository-documenti/sostenibilt%C3%A0/italiano/2021/Second%20party%20opinion.pdf	Financial Corporate	Europe	Buildings,	0.75%	https://cbonds.com/bonds/953461/
Intesa Sanpaolo	1300000000	EUR	1569720000	18-01-2021		Italy				Europe	Energy,		
Intesa Sanpaolo	750000000	EUR	830857500	04-12-2019	04-12-2024	Italy	ISS-ESG	https://group.intesasanpaolo.com/content/dam/portalgroup/repository-documenti/sostenibilt%C3%A0/italiano/191118_ISP_SPO_Final.pdf	Financial Corporate	Europe	Energy, Tran	0.75%	https://cbonds.com/bonds/646843/
Intesa Sanpaolo	500000000	EUR	559000000	27-06-2017	27-06-2022	Italy	Vigeo EIRIS	http://group.intesasanpaolo.com/scriptIsir0/si09/contentData/view/170612_ISP Green Bond_Second Party Opinion_FV.PDF?id=CNT-05-00000004DAFC6&ct=application/pdf	Financial Corporate	Europe	Energy, Build	0.88%	https://cbonds.com/bonds/322259/